Modelling the Risks of International Trade Contracts

Iryna Bashynska, Olena Sokhatska, Tetiana Stepanova, Marina Malanchuk, Sergii Rybianets, Oksana Sobol

***Abstract*: Current globalization trends in the global economy and trade, as well as integration processes, have significantly aggravated competition and complicated the nature of the foreign economic interaction of companies from different countries. At the same time, the ambiguity in the development of these processes is expressed by the increased degree of probability of the influence of numerous uncertainty factors in international markets, generating a set of specific foreign trade risks and financial losses; which are exposed to most foreign and domestic companies engaged in foreign economic activity. The contract risk management methodology proposed in the article will allow the decision-maker: to avoid opportunity costs and direct costs, as well as take preventive measures commensurate with the risks.**

A company may consider several alternative strategies: attract a contractor (accept risk); attract a contractor while maintaining control over business processes (mitigate the risk) and provide the service yourself (avoid the risk associated with attracting contractors).

***Keywords* : International Trade, Contracts, Modeling, Risks.**

I. INTRODUCTION

Current globalization trends in the global economy and trade, as well as integration processes, have significantly aggravated competition and complicated the nature of the foreign economic interaction of companies from different countries [1]. At the same time, the ambiguity in the development of these processes is expressed by the increased degree of probability of the influence of numerous uncertainty factors in international markets, generating a set of specific foreign trade risks and financial losses; which are exposed to most foreign and domestic companies engaged in foreign economic activity (FEA) [2-4].

Despite the fact that most of the risks of international trade are formed in a competitive market environment, they are also due to other reasons. In particular, the economic and political instability of the development of individual countries, military conflicts in international regions, expanding the boundaries of the premises and risk factors and at the same time increasing the scale of the monetary and financial losses of foreign companies operating here [5]. The global financial and economic crises, exacerbating the instability of the situation and position of companies in international markets, have a significant impact on the modern environment of global trade risks [6-9]. Along with this, the subjects of foreign economic activity, providing the most profitable direction of international integration, are objectively associated with in-country production, business and management risks that complement the systemic risks of international trade.

The realization of the interests of the subjects of contractual legal relations implies the possibility of obtaining not only a positive result (in the form of achieving the desired good, usually profit), but also the possibility of unprofitable consequences [10-11].

This is especially pronounced in the sphere of international commodity exchange, which is characterized by the greatest degree of uncertainty, the complexity of trade relations, invariance, multifactor and dynamism.

II. RISKS OF INTERNATIONAL TRADE CONTRACTS

Modern economic relations cannot exist chaotically, outside the framework of legal regulation. In this regard, the importance of developing the category of "risk" (contract risk) is updated, a look through the prism of which allows you to effectively manage activities in the product market in the conditions of scenario uncertainty, and also makes it possible to evaluate from a new angle the legal structures and legal means available from the point of view view of their economic feasibility. Foreign trade risk is only then included in the system of contractual risks when it is potentially managed by a foreign trade contract (this goal is achieved by influencing not only the risk factor but also minimizing it by numerous contractual means).

Risk is often characterized by “an attitude towards potential events and consequences, or to a combination of them”, and risk is described as “a combination of the consequences of an event ... and the associated probability”. Therefore, the elements of risk are also the probability and sources of risk. Thus, risk can be described as a combination of the following elements, shown in Fig. 1.

Revised Manuscript Received on September 06, 2019

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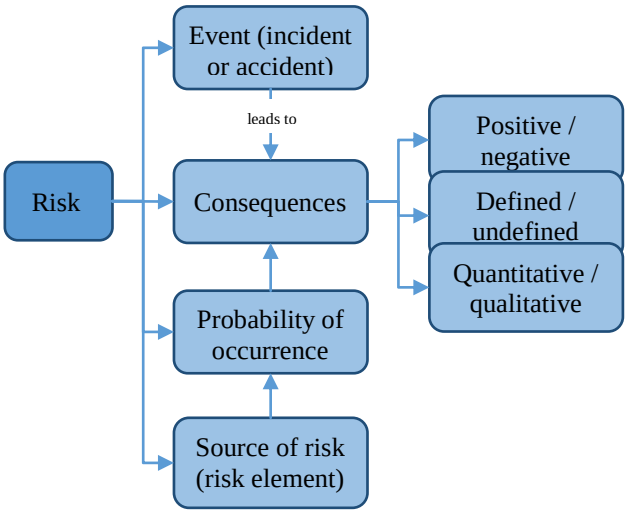

Fig. 1. Risk and its elements.

In other words, to identify the risk, it is necessary to consider the event that may happen (the level of uncertainty is characterized by the probability of occurrence) due to the presence of sources of risk, and also to predict its possible consequences. These consequences, in turn, will affect personal and organizational goals.

III. A BRIEF DESCRIPTION OF RISK ASSESSMENT METHODS

Types of methods

The classification of methods is associated with the stages of the risk assessment process:

- risk identification;
- risk analysis - analysis of the consequences;
- risk analysis - a qualitative, mixed or quantitative assessment of the probabilistic characteristics of the risk;
- risk analysis - assessment of the effectiveness of existing controls;
- risk analysis - a quantitative assessment of the level of risk;
- comparative risk assessment.

For each stage of the risk assessment process, the applicability of the risk assessment method is determined on a scale: it is strictly applicable, applicable and not applicable (Table 1).

Table- I: Characterization of the applicability of risk assessment methods

Method Name	Risk assessment process				
	Risk identification	***Risk analysis***			***Comparative risk assessment***
		Consequence	Probabilistic characteristics	Risk level	
Brainstorm	SA*	NA**	NA	NA	NA
Structured or partially structured interviews	SA	NA	NA	NA	NA
Delphi Method	SA	NA	NA	NA	NA
Control sheets	SA	NA	NA	NA	NA
Preliminary Hazard Analysis (PHA)	SA	NA	NA	NA	NA
Hazard and Operability Study (HAZOP)	SA	SA	A***	A	A
Hazard Analysis and Critical Control Points (HACCP)	SA	SA	NA	NA	SA
Toxicological risk assessment	SA	SA	SA	SA	SA
Structured scenario analysis using the "what-if" method (SWIFT)	SA	SA	SA	SA	SA
Scenario analysis	SA	SA	A	A	A
Business Impact Analysis (BIA)	A	SA	A	A	A
Root Cause Analysis (RCA)	NA	SA	SA	SA	SA
Failure Mode and Effect Analysis (FMEA)	SA	SA	SA	SA	SA
Fault Tree Analysis (FTA)	A	NA	SA	A	A
Event Tree Analysis (ETA)	A	SA	A	A	NA
Analysis of the causes and consequences	A	SA	SA	A	A
Cause and effect analysis	SA	SA	NA	NA	NA
Layers of Protection Analysis (LOPA)	A	SA	A	A	NA
Decision Tree Analysis	NA	SA	SA	A	A
Human Resources Administration (HRA)	SA	SA	SA	SA	A
Bow Tie Analysis	NA	A	SA	SA	A
Reliability Maintenance	SA	SA	SA	SA	SA
Hidden Defect Analysis (SA)	A	NA	NA	NA	NA
Markov analysis	A	SA	NA	NA	NA
Monte Carlo simulation	NA	NA	NA	NA	SA
Bayesian Analysis and Bayesian Networks	NA	SA	NA	NA	SA
FN Curves	A	SA	SA	A	SA
Risk indices	A	SA	SA	A	SA

Impact and Probability Matrix	SA	SA	SA	SA	A
Cost-Benefit Analysis (CBA)	A	SA	A	A	A
Multicriteria Decision Analysis (MCDA)	A	SA	A	SA	A

* SA - strictly applicable.
** NA - not applicable.
*** A - applicable.

Factors affecting the choice of risk assessment method are:

- the complexity of the problem and the methods necessary for risk analysis;
- the nature and degree of uncertainty of a risk assessment based on available information and compliance with objectives,
- essential resources: temporary, informational, etc.;
- the ability to obtain quantitative estimates of the output data.

Examples of risk assessment methods are given in Table 2, where for each technique, the level of compliance with these criteria is indicated on a scale: high, medium or low.

Table- II: Factors affecting the choice of risk assessment methods and taking into account the specifics (contractual relationship)

Name of risk assessment method	Description	Significance of influencing factors			Ability to get quantitative output
		Resources and Opportunities	Uncertainty	Complexity	
	Observation Methods				
Control sheets	A simple form of risk identification. The method allows the user to present a list of sources of uncertainty that need to be considered. Users use a previously developed list, codes (codes of practice) and standards	Low	Low	Low	No
Preliminary Hazard Analysis	A simple inductive analysis method, the purpose of which is to identify hazards, hazardous situations and events that could harm the organization's activities, equipment or systems	Low	High	Average	No
	Helper Methods				
Structured Interview and Brainstorming	A way to get a set of ideas and ratings ranked by a team. Brainstorming can be stimulated by using one-on-one or one-on-one interview methods.	Low	Low	Low	No
Delphi Method [12]	A method of obtaining expert assessments that can help in identifying the sources and effects of a hazard, quantifying the likelihood and consequences and an overall risk assessment. This is a method of summarizing the opinions of experts. The method allows independent analysis and expert voting.	Average	Average	Average	No
Structured scenario analysis using the "what-if" method (SWIFT)	A system that helps a team of professionals identify risk. Usually used in small meetings. Typically used in conjunction with risk analysis and assessment methods.	Average	Average	Any*	No
Human Resources Administration (HRA)	A method for studying the effect of the human factor (HRA) on the system and assessing human errors that affect the operation of the system.	Average	Average	Average	Yes
	Scenario analysis				
Root cause analysis	A method of analyzing losses that have occurred, used to establish their causes and to find ways to improve the system or the process of preventing similar injuries in the future. In the process of analysis, it is necessary to study the management methods used locally at the time of the occurrence of losses and the possibility of improving management.	Average	Low	Average	No
Scenario analysis	A method for investigating and identifying possible scenarios of events by presenting or extrapolating known hazardous facts and risks, assuming that each of these scenarios can occur. The technique can be used formally or informally; the analysis can be qualitative or quantitative.	Average	High	Average	No
Business Impact Analysis	The method allows you to analyze the risk of violation (destruction) of crucial activities of the organization and identify the ability to manage these violations (destruction).	Average	Average	Average	No
Fault Tree Analysis	The method according to which a system failure (main event) is identified and then the ways of its occurrence are determined. These paths are graphically represented as a logical tree diagram. Using the fault tree, investigate ways to reduce or eliminate potential causes/sources of failure.	High	High	Average	Yes
Event Tree Analysis	The method, according to which inductive conclusions are used to assess the probability of the occurrence of events and their transition to other events.	Average	Average	Average	Yes
Analysis of the causes and consequences	A method that combines the techniques of the fault tree and the event tree, allowing to take into account the delay time. In the framework of the technique, the causes and consequences of the event can be investigated.	High	Average	High	Yes

Cause and effect analysis	Exposure can have several influencing factors that can be grouped into different categories. Influencing factors are often identified during a brainstorming session and displayed in the form of a tree structure or fish skeleton.	Low	Low	Average	No
	Functional analysis				
Failure Modes and Effects Analysis (FMEA) and Failure Modes and Consequences Analysis (FMECA)	FMEA (interpretation of the types and consequences of failures) is a method for identifying the types and development process of failure and its implications. There are several types of FMEA: FMEA project (or products) and their components, FMEA systems, FMEA process (for production and assembly processes), FMEA maintenance and FMEA software.	Average	Average	Average	Yes
Reliability Maintenance	FMEA can be accompanied by a criticality analysis of each type of failure, evaluated on a qualitative, quantitative or mixed scale (FMECA). An analysis of the criticality of the types and consequences of failures can be based on an assessment of the likelihood that the investigated type of failure will lead to a system failure or a risk level corresponding to a given type of failure or primary risk	Average	Average	Average	Yes
Latent defect analysis (spurious circuit analysis)	A method for identifying and implementing a maintenance policy aimed at achieving the effectiveness and efficiency of the required safety, reliability and cost-effectiveness of equipment	Average	Average	Average	No
Hazard and Health Study (HAZOP)	A method for identifying hidden project errors. To detect latent failures, they use special equipment, software, or integrated verification methods that can cause an adverse event or suspend a favourable event. These events should not be caused by component failure. These failures are random and difficult to detect during system tests. Latent failures can lead to system malfunctions, program malfunctions, and even death or personal injury	Average	High	High	No
Hazard Analysis and Critical Control Points (HACCP)	The general process of identifying potential dangers, aimed at identifying possible weaknesses or deviations in the methods of work (intended or intended). The way is based on the use of a control word system. The criticality of the identified deviations is also evaluated.	Average	Average	Average	No
Protection Level Analysis (LORA)	A system of preventive actions aimed at ensuring product quality, process reliability and safety, based on the use of monitoring and measurement of specific characteristics that must be within established boundaries (critical control points)	Average	Average	Average	Yes
Bow Tie Analysis	The method allows you to evaluate controls and their effectiveness. (The technique is called barrier analysis.)	Average	High	Average	Yes
	Statistical Methods				
Markov analysis	Markov analysis is sometimes called state analysis; it is usually used in the analysis of complex reconstructed systems, which can be in various states, including states with poor performance	High	Low	High	Yes
Monte Carlo simulation	Monte Carlo simulation is used to establish changes in the system that result from changes in the input data of the system, taking into account the distribution of input data and their relationship with the output data. The analysis can be used for a model that determines the relationship between input and output data. Input data can be described as random variables by corresponding distributions and their inherent uncertainty. Triangular distributions of beta distributions are usually used to assess risk.	High	Low	High	Yes
Bayesian analysis	A statistical procedure that uses an a priori distribution of data to assess the likelihood of results. The accuracy of the Bayesian analysis results depends on the accuracy of the a priori distribution. Bayesian network models causation based on the analysis of probabilistic relationships of input data and results	High	Low	High	Yes

* The complexity depends on the features of the task.

IV. MODELLING THE RISKS OF INTERNATIONAL TRADE CONTRACTS

As can be seen from the table, the most effective methods are all Statistical Methods, Fault Tree Analysis, Analysis of the causes and consequences, Bow Tie Analysis.

Let us consider the most suitable, from our point of view, the method for risks of international trade contracts - Bow Tie Analysis.

A. Overview

Bow-tie analysis is a schematic way of describing and analyzing the path of a dangerous event from cause to effect. This method combines the investigation of the causes of an event using a fault tree and the analysis of consequences using an event tree. However, the focus of the bow-tie method is focused on the barriers between causes and dangerous events and dangerous events and results. Bow-tie diagrams can be built on the basis of identified faults and event trees, but more often they are made directly in the process of brainstorming.

B. Scope

A bow-tie analysis is used to study risk based on a demonstration of a range of possible causes and consequences. The method should be used in situations where it is difficult to conduct a full analysis of the fault tree or when the study is more focused on creating barriers or controls for each failure path.

The method can be useful in situations where there are well-established independent paths leading to failure.

Bow-tie analysis is often much easier to understand than an event tree or fault tree analysis, and therefore it can be useful for exchanging information using more complex methods.

C. Input

The input to the method is information on the causes and consequences of hazardous events, risk, barriers and controls that can prevent, mitigate or stimulate them.

D. Method execution process

A bow-tie analysis should be constructed in accordance with the following procedure.

a) Identify the hazardous event selected for study and display it as the central node of the bow-tie.

b) Listing the causes of an event by examining the sources of risk (or danger).

c) Identification of a hazard development mechanism prior to a critical incident.

d) Drawing a line separating the cause from the event, which allows you to form the left side of the butterfly. Additionally, factors that can lead to the escalation of dangerous activity and its consequences can be identified and included in the diagram;

e) Drawing vertical barriers across the line corresponding to obstacles to prevent undesirable effects. If factors are identified that can trigger an escalation of a hazardous event; then, additional restrictions can be presented in order to avoid such an escalation. This approach can be used for positive consequences when the barriers reflect the controls that stimulate the appearance and development of the event.

f) Identification on the right side of the butterfly of the various consequences of dangerous activity and the drawing of lines connecting the central event with each possible result.

g) Image of barriers as barriers to the aftermath. This approach can be used for positive consequences when the boundaries reflect the means of control that ensure the appearance of favourable results;

h) Display under the bow-tie diagram of the auxiliary controls related to restrictions (such as training and checks) and connecting them to the appropriate authorities.

In the bow-tie diagram, some types of quantitative assessment can be applied, for example, in a situation where the paths are independent, and the probability of specific consequences or results is known. Such a quantitative assessment is necessary to ensure management effectiveness. However, it must be borne in mind that in many situations, the paths and barriers are interdependent, and the controls can be associated with the chosen evaluation method. Therefore, the management effectiveness is uncertain. Quantification for bow tie analyzes is often performed using the FTA and ETA methods.

E. Output

The output of the method is a simple diagram showing the main paths of hazardous events and the barriers established to prevent or mitigate unwanted consequences and / or enhance and accelerate the expected effects.

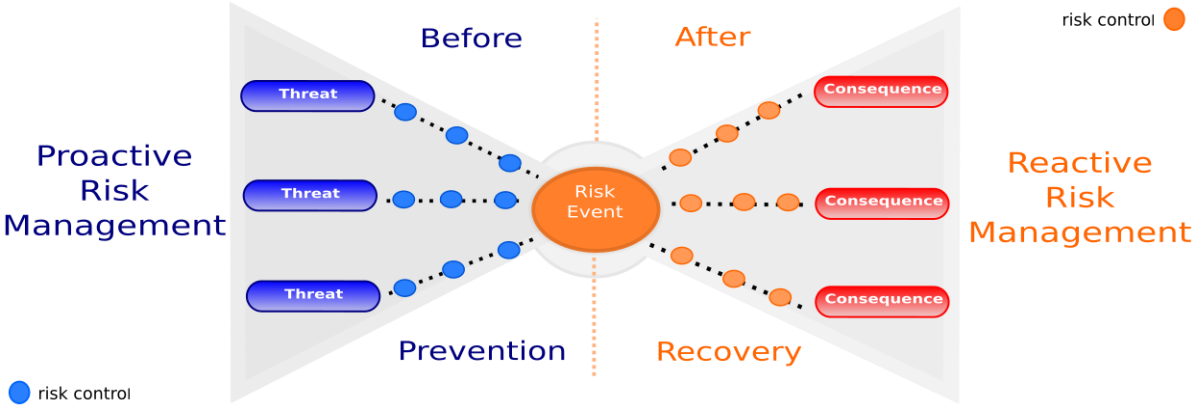

Fig. 2. Bow Tie Sample Diagram for Unwanted Consequences

F. Advantages and disadvantages

The benefits of the bow-tie analysis method are as follows:

- The process provides a clear, simple and precise graphical representation of the problem.
- The method is focused on controls aimed at preventing and/or reducing the consequences of dangerous events and assessing their effectiveness.
- The technique can be applied in relation to beneficial effects.
- The application of the method does not require the involvement of highly qualified experts.

The disadvantages of the method are as follows:

- The method does not allow to display the totality of causes that arise simultaneously and cause consequences (the case when the logical element "And" is located in the fault tree that reflects the left side of the diagram)
- The method can present complex situations in an overly simplified form, especially when applying quantitative assessment.

In order to understand how these elements are interconnected, we will continue to use the example of a company that decides to involve a contractor operating in another country with significantly lower operating costs in providing customer support services. The main risk will be that regular customers may not like the quality of services, and they will terminate the contract. The interaction of risk elements

in such a scenario is shown in Figure 3.

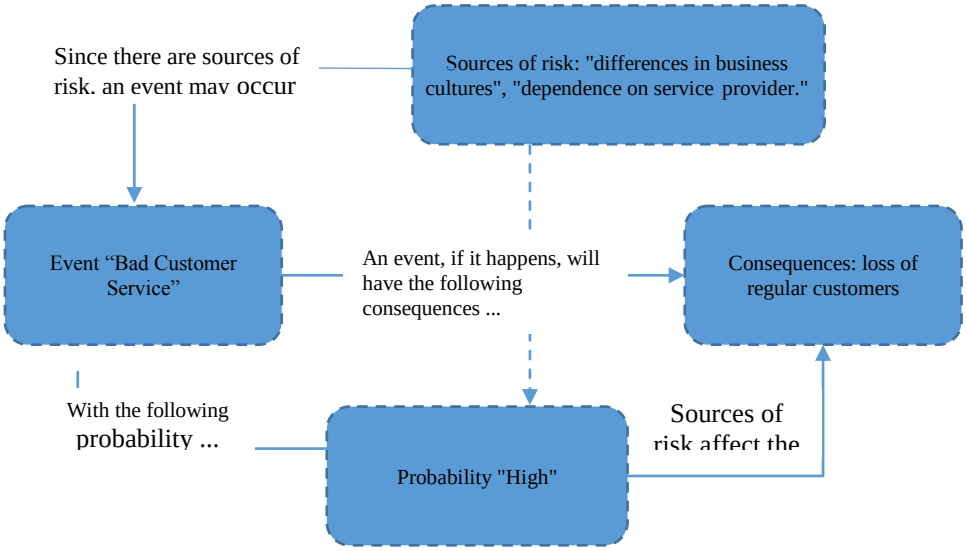

Fig. 3. Relationship between risk parameters.

If a company involves a company with a completely different business culture in rendering customer support services or if there are flaws in the contract that limit the influence of the company on the quality of the services provided, these two elements, each individually or in combination with other factors, may lead to events - the loss of a regular customer.

Both of these factors also have a substantial effect on the likelihood of an event occurring. For example, with an insufficient assessment of the contract, the probability of customer dissatisfaction with the quality of services is much higher. Similarly, if a firm engages a company from a country in which it is familiar with a service, the likelihood of an adverse outcome will be lower than in a situation where both sources of risk are present.

In this case, even if both sources of risk are present, there is no certainty that the event will occur. If something is already known - if we are confident that customers will be disappointed - then this is not a risk, it is a fact. If an event occurs, its consequences will be the loss of a regular customer (direct costs) or damage to the reputation of the company.

Then, the firm may decide to implement a risk management strategy to minimize the "effect of uncertainty on the organization's goals".

V. RESULT AND DISCUSSION

The use of risk management tools will allow the decision-maker to:

1) Avoid opportunity costs;
2) Avoid direct costs;
3) Take precautionary measures commensurate with the risks.

A firm may consider several alternative strategies:

- Attract a contractor (accept risk);
- Attract a contractor while maintaining control over business processes (mitigate risk);
- Provide the service yourself (avoid the risk associated with attracting contractors).

Risk management, as we have already said, is a prerequisite (although not the only one) to achieve personal and organizational goals. This, in turn, requires the systematic implementation of processes.

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