Implementation of security management principles in transport

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Abstract.

Research background: Transport is one of the key factors in the development of any modern society, and it is not only a goal but also a means of economic development on a global scale. Within the article, we focus on road freight transport, which has the largest market share in the transport sector on the quantity of transported goods. Fuel consumption has risen rapidly in recent times, except for a global drop in demand caused by global constraints in connection with the fight against COVID -19. Increasing the density of transport, increasing requirements for the speed and quality of transport or economic issues significantly affect the decision-making of entities involved in the process of fuel transport and they can have a significant impact on the level of risk in the transport itself. The occurrence of an emergency during the transport of fuels can have negative to tragic effects on life, health, property and the environment. These impacts are in many cases associated with high costs of eliminating these consequences or restoring them to their original state**.**
Purpose of the article: Companies, to succeed in a globally competitive environment must adopt various preventive strategies to minimize the risks and costs associated with a negative event. Choosing the optimal strategy is a challenging step in the decision-making process, so it is important to choose the right mechanism to support this decision.
Methods: The article will present a mechanism for selecting appropriate prevention strategies based on the CBA method in a case study.
Findings & Value added: Using the CBA method, it refers to the economic benefits associated with the implementation of preventive measures based on conducting a voluntary risk assessment of transport companies.

Keywords: decision-making process, emergency event, globally competitive environment, risk assessment, transport companies.

JEL Classification: *D81, H19, R41.*

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1 Introduction

The growing trend of product transportation on a global scale is affecting the transportation of petroleum products (fuels), too. The process of transporting fuels is not a simple process. The transport of fuels by road tankers is associated with many risks compared to freight truck transport. In addition to the possibility of explosion and fire of products in the event of a tank accident, there is a risk of extensive damage to the environment, human lives or health. Every day, we are informed through various media about road traffic accidents and their various consequences - the number of people injured and killed, the amount of hazardous substances leaked, damage to property and the environment.

Security management is a young, rapidly developing management discipline focused on the security of reference objects [1, 2, 3]. In relation to the organization as a reference object, security management deals with solving security issues in all its sectors. In general, it is possible to talk about different types of organizations, their premises and individual objects, or means in which different types of assets are located (persons, property in the form of tangible and intangible assets, ...) [4, 5]. From the point of view of transport organizations, security management is one of the prerequisites for the successful existence of an organization in a turbulent global environment [6, 7, 8]. The basic principles of security management, applicable in general, are presented in Figure 1.


Fig. 1. Security management principles. Source: [4].

The article will primarily focus on the principle of efficiency. This principle means that the effectiveness of the security system is achieved by the fact that the cost of protective measures should not exceed the expected losses due to the exposure to security risks [4]. If the security system fails to effectively protect the organization's assets, then the consequences of a negative event will be increased by the costs we incurred to create a security system [9]. One of the methods that are used in practice to increase the efficiency of spent resources is the Cost Benefit Analysis (CBA) method. The method is also recommended in the best practice of risk management by the international standard IEC 31010.

2 Method

CBA analysis is a methodical approach that gradually responds to the basic question: What does the implementation of the project bring to and to whom does it take? [10, 11]. The effects of the action thus defined are gradually aggregated, transferred to cash flows and included in the calculation of decisive indicators that can determine whether or not the project is a contributing factor to the company. When comparing two or more projects, then they allow calculated pointers to determine their order, or to prioritize one project before

the other [12]. In general, cost-benefit analyses are compiled from two basic parts, namely financial and economic analysis. Financial analysis works with financial costs and income [13]. Its main objective is to evaluate the project in terms of financial efficiency for the investor. The economic analysis also takes account of all the direct and indirect benefits of all the actors concerned. A key factor is not a profit but a socio-economic impact that is an economic recovery. The overall cost-benefit analysis of the safety framework related to the assessment process and the risk management process is illustrated in Figure 2.
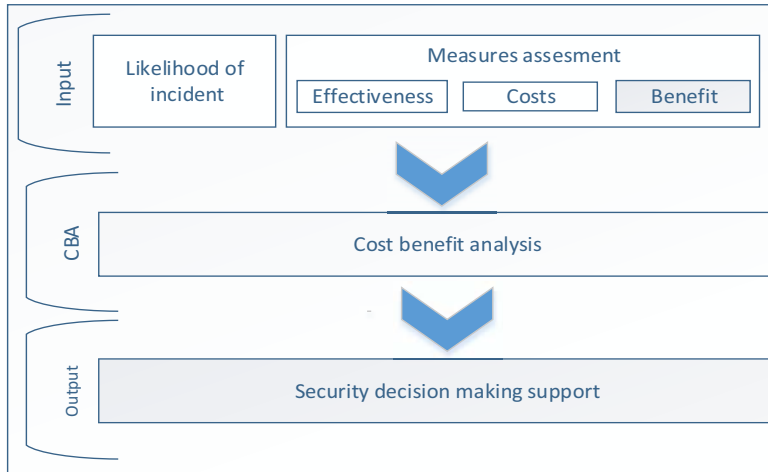
Fig. 2. Cost Benefit analysis process within the security framework. Source: authors.

The CBA method in security management is specific in that it must meet the established risk management procedures and, in the final phase, also reflect the reduction of the level of risk by the decision taken. The basic starting point of this method is therefore the risk assessment process (Fig.2). As part of the Likelihood of incident step, the various occurrences of incidents in the selected subject are identified, analysed and evaluated in detail [14]. Based on the probability of incidents described in the scenarios, it is then possible to propose preventive measures for a specific incident scenario.

The result of the effectiveness process is an evaluation of the effectiveness of the proposed prevention option for a specific incident scenario. This means assessing the risk of, for example, an accident that occurs before and after preventive measures are taken. This step is important in terms of cost estimates and especially the benefits of implementing a preventive measure.

The Process Cost is designed to evaluate the cost of each risk mitigation measure within a given scenario. These costs include, for example, the direct costs of implementing the preventive measure and the indirect costs associated with its application.

The Benefit process defines the costs derived from the selected incident scenario. Accidental losses may include death, environmental damage or loss of property. Losses defined in this way are translated into cash flows and represent the benefits that we obtain from the implementation of measures. The last step of the CBA method is to calculate the net benefit or net present status for each relevant scenario and the specific preventive measures proposed.

2.1 Case study: Selecting appropriate prevention strategies based on the CBA method in transport company

The subject of interest is the reduction of the risk of a traffic accident during the transport of fuels on the basis of the implementation of new preventive strategies. Based on the legal framework of the transport company and the recommendations of the 31,000 standard, an extensive risk assessment process was carried out. The risk of an accident was defined as a critical risk for the company. The results of the risk assessment for a given risk are presented in the table Table 1.

Table 1. Risk register – extract. Source: authors.

Risk	Responsibility for risk	Probability	Consequences	Risk management
Car accident	Authorized person	Moderate	Major	Preventive strategy - transport safety

Based on the recommendations, various strategies have been developed to reduce this risk. The company applied the CBA method in selecting the optimal strategy. The company proceeded in the evaluation on the basis of the framework related to the assessment process Figure 2, while in the case of the study the emphasis is placed on the specificity of this method within the safety management. The transport company identified the beneficiaries, namely: the transport company, customers and suppliers and those involved in the accident.

To define the zero variant, the company relied on individual causes, which were identified on the basis of the FTA method:

- Driver inattention
  - Microsleep - 10 times a year
  - Reduced attention - 20 times a year
- Unsuitable road conditions
  - Rain - 100 times a year
  - Ice coating - 50 times a year
- Foreign fault
  - Excessive speed - 20 times a year
  - Failure to adhere to traffic regulations- 30 times a year
- Failure to respect the rules of the road - 30 times a year
  - Underestimation of a sharp turn - 5 times a year
  - Excessive speed - 15 times a year.

Each cause is assigned a value that represents the potential for that cause to occur. In terms of financial costs for the transport company, the structure of impacts is defined, such as non-delivery of materials to the customer, collapse of transport, explosion of the vehicle, pollution of water, soil, etc. The expected financial impact on the company is estimated at several thousand euros and depends on the impact scenario. If a fatal accident were to be considered, the financial impact would be incalculable in terms of loss of life.

3 Results and discussions

The aim of the investment project is to minimize risk by implementing a defined strategy. This strategy defines the basic starting points for risk reduction, such as driver retraining, simulation of accidents and the definition of accident procedures, first aid courses, safety measures and the installation of car assistance systems. Based on the performance of expert assessments [15], the risk reduction was estimated to be 50% compared to the zero option.

As part of the implementation of the CBA method, this estimate serves us for a more thorough assessment of the individual causes of the risk of a traffic accident and, of course, for the estimation of costs and benefits. The calculations of the CBA method take into account the risk values before and after the implementation of the measures.

The results of the CBA method are presented in the table (Table 2). The operational phase included costs related to the implementation of measures to reduce the incidence of risk - traffic accident. These operating costs include the control of the system installed in the vehicle, the annual provision of external companies to train drivers in the area of possible risks during transport, training in the provision of first aid, a company to simulate traffic situations as well as ensuring regular inspections of tanks. The total annual estimated costs were defined by the company at € 700,000. All measures envisaged in the project will be implemented annually over a period of 5 years. As part of the benefits, the company counted on market resp. in some cases shadow prices. Further details on the quantification of socio-economic benefits are provided in Table 2.

Table 2. Calculation of benefits and costs for the monitored period (source: authors).

Cost&Benefit (in thousands of Euros)	2020	2021	2022	2023	2024
Company incomes Zero variant	205 000	205 000	205 000	205 000	205 000
Company incomes Investment variant	206 000	206 000	206 000	206 000	206 000
Cash flow Benefit	1 000	1 000	1 000	1 000	1 000
Cost & Benefit / period	**2020**	**2021**	**2022**	**2023**	**2024**
Estimated expenses Zero variant	1 000 000	1 000 000	1 000 000	1 000 000	1 000 000
Estimated expenses Investment variant	101 500	100 700	100 700	100 700	100 700
Cash flow Cost	1 500	700	700	700	700

The Cost Benefit analysis indicators obtained on the basis of a cost-benefit assessment, taking into account the expert estimate of reduced risk, are the net present value (NPV), which in this case has a value of € 45,095.63 and a return index PI = 0.6340. When evaluating these two indicators we can state that the project is profitable, but when choosing strategies, there must be a process of choosing between several prevention strategies.

4 Conclusion

The paper presents a brief framework of the CBA method within a transport company. One of the basic principles of safety management is pointed out, namely efficiency. This principle is linked to the CBA method, based on which the transport company is competent to implement the decision on the correct application of preventive measures. Not only the results of the CBA method play a role in this decision, but also the ability to reduce the level of risk given by the implemented strategies.

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