UNIVERSITY OF PARDUBICE
FACULTY OF TRANSPORT ENGINEERING

# RISK MANAGEMENT IN TRANSPORT COMPANIES FOLLOWING THE TRANSPORT POLICY OF THE CZECH REPUBLIC

DOCTORAL THESIS PRECIS

**2021** **Ing. Iveta Oborilová**

**Author**

Ing. Iveta Oborilová

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# CONTENT

# INTRODUCTION

Transport in the Czech Republic has been witnessing fast economic changes and globalisation trends, which is reflected in the national strategic documents and in strategies of transport companies and their management. The Czech Republic, as a member of the European Union, is obliged to meet the duties and commitments resulting from the membership, which concerns transport policy, among others. Changes triggered by the national transport policy affect business environment of the sector and transport companies´ management is required to timely identify such changes, assess their importance and take them into account in their business activities.

Transport policy involves economic, social and environmental aspects which can present opportunities as well as threats for a company. Any decisions made by company management in regard to their future are connected with a certain risk factor and its possible influence. The transport sector must pay attention to the specifics of transport business in regard to its nature.

The dissertation focuses on the transport policy relating risks in the Czech Republic, especially in companies operating road freight transport. Several reasons exist why the author selected these companies. New trends in transport have been showing increased popularity of road transport compared with rail transport while the road freight transport keeps – with certain deviations – growing in the recent years. The road freight transport volume in the Czech Republic covers about 70% of the whole freight transport.

The dissertation aims to make a model supporting the search for and assessment of risk factors resulting for road freight transport operating businesses from the National Transport Policy of the Czech Republic (and the relating documents), which would facilitate the formation of suitable measures for the reduction or elimination of risk factors with negative impact and, on the other hand, use the identified opportunities. The findings of risk management have been used for the above described purpose.

The dissertation monitors the transport policy aspects from a company´s point of view. Key factors of a company´s success or failure can be found in its vicinity, as well as they can have connection with its resources. In the interaction with its environment, the changes can be reflected in changes of the resources and their use, which can lead to the strengthening of a company´s positives, as it can reduce its potential due to the lack or insufficient use of the resources. Therefore it is essential that the model considers the external influence factors as well as the company´s internal environment.

# 1 CURRENT STATE OF THE SOLVED PROBLEM

This chapter summarises the current state of the knowledge in the given field.

## 1.1 Definition of basic concepts

The analysis of the current state of the art accepts the meaning of transport in view of the national economy and focuses on the sector regulating strategic documents in connection with the duties of the Czech

Republic resulting from is membership in the European Union. In terms of transport operators, it is essential to take into consideration that transport policy induces changes in their environment which consequently influence their business. Each of such changes represents a risk, therefore it is essential to define, classify and describe the ways of its identification.

### *1.1.1 Current state of transport in the Czech Republic and abroad*

Transport in the Czech Republic is one of the most important sectors of the national economy which participates in the GDP formation by a maximum of 10%. In 2019, the transport sector employed about 270 thousand people (i.e. 8% of the jobs); transport relating logistic activities participated in logistic costs by 38% (the Ministry of Trade and Industry of the Czech Republic, 2020). The European Commission estimated an interim 7.8% GDP decline for the Czech Republic in 2020, and consequently, only 4.5% growth compared with 2020 (European Economic Forecast Summer, 2020).

The core of the transport system in the Czech Republic is road and railway transport. Road freight transport prevails, representing over 70% of land transport in the European Union, which also applies for the Czech Republic (Eurostat*:* Energy, Transport and Environment Statistics, 2019, European Commission, 2019).

### *1.1.2 Characteristics of the transport policy*

Transport policy can be described in terms of its objectives, functions and impact. Eisler (2005) and Orava (2012) differentiate the following functions: complementary, stimulating, substituting and social-stabilising Transport policy objectives aim at the growth stimulation, facilitating social inclusion or improving sustainability. (Berg et al., 2017). Transport policy impact is a consequence of their measures. (Navrátilová, Rozmanová et al., 2016, Rodrique, 2020).

### *1.1.3 Strategic documents in transport sector in the European Union and in the Czech Republic*

The European Union attempts at a unified transport infrastructure and a standardised transport policy with the objective to ensure a smooth, effective and free motion of people and goods across the EU (the Ministry of Transport of the Czech Republic, 2020a). According to Coito et al. (2020), transport policy is being harmonised, which recently concerns the interstate legal and administration regulations in transport services.

Basic documents in the European transport policy outlining the main strategic visions in transport sector are the White Book of Transport (the Ministry of Transport, 2020a) and the itinerary Transport 2050 followed by the Policy of Trans-European Transport Networks TEN-T. The complex transport strategy introduced in the White Book is complemented by further strategic documents, e.g. framework programmes Horizon 2020 and Horizon Europe for the period 2021 – 2027, by concepts dealing with energy in transport, Smart Cities, etc. In 2020, the European Commission introduced the Strategy for Sustainable and Smart Mobility together with the Action Plan containing 82 initiatives in 10 key areas to be developed by the European Commission in the following four years. The result should be – in line with the European Green

Deal – reduction of transport-relating emissions by 90% before 2050 (the European Commission, 2020). The new strategy is expected to replace the White Book of Transport as a vision of the European Commission in the transport sector. The Transport policy of the Czech Republic involves the period of 2014-2020 with prospects to 2050 (Government Resolution No. 449) which is connected, in regard to the road freight transport, with the Transport Sector Strategies, 2nd stage. The freight transport concept for the period 2017-2023 with the prospect to 2030 (taking in consideration the multisector and sector national documents), action plans and operational programmes. At the time of compiling the dissertation, the boundary mark was 31 December 2020 when Czech the minister of transport was expected to report about the assessment of the Freight Transport Concept. The draft Operational Programme Transport 2021-2027 is prepared for the following period, which is based on the National Concept of Coherence Policy in the Czech Republic after 2020. The programme was approved by the meeting of the minister of transport in January 2020 (the European Union, 2020; European Structural and Investment Funds, Operational Programme Transport).

### *1.1.4 Risks and risk management in road freight transport operating companies*

The notion of risk appears quite often in the world of economic science; despite its unified and generally recognised definition does not exist (Haimes, 2009). However, the authors usually connect risk with uncertainty and its consequences (Hittmár, 2006, Cooper et al., 2004, Ostrom and Wilhelmsen, 2019).

Some definitions only focus on the negative aspect of a risk, where risk is understood as a certain threat (Vochozka and Mulač, 2012, Fotr and Hnilica, 2014, Blažek, 2014), while others notify of the fact that possible deviations from the expected result can also have the required direction (Fotr et al., 2012), which represents a wider notion of a risk. We understand risks in relation with a higher number of solutions where a certain option is usually undesirable. More aspects are used in risk classification, e.g. division taking certain social aspects in consideration, or a contrast-based classification.

In view of the strategic documents in transport and the relating legislation (laws and directives), we can divide risks into primary and secondary type. Primary risks are connected with a relevant standard, while the secondary ones derive from the changed conditions. Individual risk types have been dealt with by Nævestad et al. (2015), Smith, (2016), Pykhtin et al. (2017), among others.

Several types of methods exist for risk identification and assessment. An ex-ante method id the Preliminary Hazard Analysis – PHA, within which it is possible to use different techniques, such as What-If or Hazard and Operability Analysis (HAZOP), Fault Tree Analysis (FTA), Failure Mode and Effects Analysis (FMEA). Ex-post – deductive methods aim - based on the occurred risk history - to search for causes and consequences leading to a risk occurrence (Khlif, Hussaineyc, 2014). Selection of a method always involves the purpose and scope of a risk analysis; this is why we can use both quantitative and qualitative methods. According to Fotr and Hilica (2014), Allodi and Massaci (2017), the quantitative risk assessment is essential, even though it is more subjective than the quantitative attitude.

Quantitative methods are based on a mathematical calculation of a risk from the frequency of a threat occurrence and its impact. Impact is usually expressed in financial units. A risk is most frequently expressed in the form of an Annualized Loss Expectancy – ALE. The quantitative attitude is also connected with the analysis of historical data and its statistical evaluation. Quantitative methods are more demanding and time consuming; however, they provide the financial expression of a risk and are more objective compared with the qualitative methods. Among the most frequently used quantitative methods are Even Trees Analysis (ETA), Fault Tree Analysis (FTA) and multi-criteria decision making methods (Ahmed et al., 2007). Further methods are Causes and Consequences Analysis (CCA), Failure Mode and Effect Analysis (FMEA) and its modifications. The Monte Carlo method is also useful, involving a calculation based on multiple repeated random experiments (estimates of a random quantity). Akyildiz and Mentes (2017) recommend fuzzy sets for risk identification and assessment. Among the qualitative methods suitable for identification appears the Delphi method and brainstorming. Risk factors and their mutual relations can be expressed graphically by means of cognitive maps. The required methods can be further selected according to the type of risk which is searched for and assessed. Financial risk is usually assessed by means of financial analysis, often focusing on cost amount (Cost Minimization Analysis – CMA), or on the analysis of costs and benefits (Cost Benefit Analysis – CBA). **Safety risk** focusing methods are summarised as PSA (Probabilistic Safety Assessment). QRA – Process Quantitative Risk Analysis focuses on the assessment of probability and consequences of dangerous events (Taylor, 2016, Goerlandt et al, 2017, Pasman et al., 2017). A simple scoring method (JBM) (Neugebauer, 2017) is used for the **work risk assessment**. Human factor reliability (HRA) is used in the assessment of **human factor reliability**. Taking in consideration the management level, which requires information about possible risk, we can differentiate among analyses designed for the strategic, tactical and operative management. In relation to the state transport policy, it is most important to obtain information for the top management, i.e. strategic information. Therefore the strategic situation analysis of business environment can be used (Fotr, Hnilica, 2014).

To complete this chapter, it is vital to indicate that risk assessment involves several stages: it can comprise four (Gul and Ak, 2018) or more stages – e.g. Ostrom and Wilhelmsen (2019) differentiate between risk identification, risk analysis, risk evaluation, risk treatment and risk monitoring and review.

## 1.2 Critical evaluation of the recent knowledge in the field of the doctoral thesis

Transport sector in the Czech Republic has always been among the most important sectors; and changes of the conditions in transport business influence the environmental and social, as well as the economic field. Transport policy in the Czech Republic identifies the main sector´s problems and proposes measures for their solution as a framework only: the detailed picture is described in the connecting strategic documents (e.g. action plans).

Specialised literature determines three areas affected by transport, i.e. economic, social and environmental area. Economic impact of the transport policy is described as those changing economic

conditions of individuals or of a society. Economic aspects assessment is connected mainly with incomes from taxes and with the external cost reducing measures. Social aspects reflect formation of new jobs, with transport accessibility and with health protection. Social aspects of road freight transport in the EU legislation determining the general and sectoral framework with the aim to provide for road safety refer to the suitable work conditions and to a smooth economic competition in the sector. Identification of social aspects results in the limitations relating to the error rate caused by the omitted secondary impact and by the combination of the social and economic impacts. A specific problem is the difficult measurability of such impacts. Environmental factors of transport impact are attributed to the transport infrastructure (spatial distribution of emissions), to the traffic intensity (intensity and type of emissions) and to the used transport modes (Rodrique, 2020).

Priorities and measures contained in the Czech transport strategic documents influence enterprises because of changes they invoke, thus influencing their economic results. Despite the specialised literature introduces a number of analytical methods for the risk management, the problems of risk management in transport operating companies in link to the transport policy impact have been paid attention neither on the theoretical level nor in empiric studies. The transport policy aspects research focused especially on the national or international level rather than on the impact in terms of individual transport operating companies.

Inaccuracies in the transport terminology are obvious also in the risk definitions. Risk can be described as a phenomenon or an event arising with a certain probability which has certain consequences. However, the terminology is not unified, especially in the Czech specialised literature: risk is often substituted by a risk factor, or both terms are joined (e.g. Fotr and Hnilica, 2014). The author respects the connection of both terms; however, the design part of the dissertation prefers the term “risk factor”. The reference literature research demonstrates that risk is most frequently connected with a threat, despite it can be also understood as an opportunity. The same is reflected in the risk categories used for their identification. Division of risks and method is varied and rather unclear – this is why the methods in the dissertation are divided into groups according to the selected criteria (time, purpose, quantitative and qualitative expression of quantities, risk types and management level).

Risk analysis in specialised literature is usually understood as a two-phase process where risk factors (influence, events or phenomena with the potential to positively or negatively influence company activities and thus the company resources) are identified first, and then their impact (importance) assessment follows. This is the way of risk assessment; however, assessment in view of its acceptability or unacceptability represents further, independent step which ties up to the risk analysis. The two-phase risk analysis procedure is accepted in the dissertation. Risk factors are identified and assessed in terms of their impact, aiming to determine the risk importance of the unquantifiable or difficult to quantify risk) or a scope of the risk (at quantifiable risks).

# 2 OBJECTIVES OF THE DOCTORAL THESIS

The main objective of the dissertation is **to design a model for identification and assessment of risk factors in companies involved in road freight transport in relation to the Transport Policy of the Czech Republic**.

The background for the dissertation is the concept of an enterprise as a social and economic system interacting with its environment. This is the reason why the management needs to react to the external and internal company´s environment changes. As for the external environment, it is important to identify especially threats; however, it is suitable to focus also on the opportunities such changes may elicit. The internal company environment, i.e. its strengths or weaknesses, determine whether and to which scope it is possible to eliminate the treats and use the opportunities.

To achieve the dissertation objectives, it is essential to fulfil the following partial objectives:

1. Describe the current situation of transport in the Czech Republic and the existing transport policy in the Czech Republic.
2. Determine the risk theoretically, its types and attitudes of management to the risk management.
3. Theoretically characterise the risk assessment methods.
4. Identify the type of risk factors according to the selected criteria and select methods for their identification and assessment which are suitable for road freight transport operating companies.
5. By means of quantitative research, verify the identified risk factor types and its importance (impact) and verify suitability of the selected methods in view of the selected Czech transport companies involved in road freight transport.
6. Design a model for identification and assessment of risk factors in road freight transport operating companies in the Czech Republic.
7. Verify the designed model in a selected transport operator.

In connection with the solved problem the following research questions have been identified:

What risk factors can elicit the transport policy applied in the Czech Republic in road freight transport operating companies?

Which factors does road freight transport operating company management prefer: threats or opportunities?

How does the Czech transport policy reflect in the internal environment of road freight transport operating companies?

# 3 RESEARCH METHODS

The below indicated scientific and research methods have been applied in the dissertation.

## 3.1 Scientific methods

The findings have been analysed upon reference literature research. Both the above indicated methods – analysis and synthesis have been used also in the solution of the research problem. The author applies the ratio analysis (determination of the relations between individual phenomena), causal analysis (determining causes of individual phenomena) and trend analysis (e.g. in assessment of road and railway transport development).

Synthesis is applied for determination of the main theoretical findings within assessment of the current state of knowledge (Molnár, 2012), and for searching the ways to form the methodology procedure to identify and analyse risks in road freight transport operating companies. Methodology and model design further use generalisation.

The required data from practice have been mainly collected by means of the quantitative research. Qualitative research (questionnaire, controlled semi-structured interview) uses induction, and the data have been evaluated with the objective to find a certain regularity. The quantitative research used in the selection of risk factors affecting the road freight transport operating companies is based on deduction and application of theoretical knowledge.

Abstraction is applied in the determination of risk factors on road freight transport companies with the aim to find their general characteristics based on their common features. Its pair method – concretisation – has been used in the identification of the most important risk factors in the researched areas (economic, social, environmental, safety and information), when the risk actors are assessed according to their importance for the monitored companies.

## 3.2 Empirical methods

Empirical methods used in the dissertation are comparation, questioning (an interview) and empiric assessment. Comparation is used for the risk analysis methods selected upon theoretical knowledge with methods used in the addressed companies, and to compare the found risks and their importance.

Questioning was performed in the form of an interview. The advantage of an interview compared to a questionnaire id the interpersonal contact. This is the reason why an interview has been used for determining risks in practice, with the recognised company experts. Interviews were recorded and rewritten to enable further processing of the collected information and to carry out the content analysis.

Descriptive statistics has been used for the statistical evaluation of the obtained facts, i.e. location characteristics: arithmetic average, median, modus, dispersion and root mean square deviation (according to Řezanková, 2011). The statistical data comprise the primary data (results of the research) and secondary data (taken from other resources – e.g. the Czech Statistical Office and the Ministry of Transport data).

# 4 RESEARCH RESULTS

This chapter introduces the problem solution and its results. Applicability of the risk factors determined on the basis of theoretical knowledge from specialised publications or resulting from the transport policy documents (especially the Transport Policy of the Czech Republic, Freight Transport Concept) and applicability of the methods selected upon specialised literature research was assessed within qualitative research..

## 4.1 Identification of risk factors based on the study of specialised resources

Analysis of further specialised articles and strategic documents (the Transport Policy of the Czech Republic, Freight Transport Concept) enabled the author to identify risk factors and in the planned meetings with major transport companies managers to verify whether the process risk factors set appears relevant in view of a road freight transport operating company practice. Taking in consideration that altogether 111 risk factors have been identified (of an economic, environmental, social, legislation, safety and information nature), it was essential to adjust the list for the semi-structured interview with the highly occupied specialists to be able to obtain answers to all questions relating to the predetermined tasks. Due to this problem, several groups were formed in which the risk factors were associated and described in detail. The summarisation resulted in the formation of the following areas, risk factor groups and risk factors involved in them:

**B – Transport safety:**

- Technical road safety (including the level of technical roadworthiness: safety and fluency increasing telematics, speed measuring and vehicle weighing),
- Technical road safety – intelligent transport systems ITS (eSafety application support, eCall etc.),
- Vehicle technical condition (legislation framework and MOT),
- Human factor in view of safety (awareness of road traffic participants about risky behaviour in transport, high law enforceability in failing to respect traffic regulations),

**I – Information support to transport:**

- Intelligent transport systems ITS (JSDI – unified transport information system),
- Information and communication technologies ICT (information about road closures sufficiently in advance),

**EKOL – Environmental measures:**

- Use of alternative fuel (requirements for technical adjustment of engines, hybrid engines),
- Reduction of emissions (car fleet renovation trend (e.g. in the form of road tax), limited entry of vehicles to city centres, emission limits),
- Legislation in the environment protection area (limited use of lower-class roads by heavy trucks, infrastructure protection measures),
- Logistics – city logistics (supply by means of distribution centres within city-logistics),

- Logistics – urban mobility (special mode of freight transport in cities, especially in historical centres material supply),
- Logistics – logistic centres (stress on the public logistic centres and multimodal transport),
- Toll system (maximised differentiation according to vehicle emission classes, number of axles, pressure per an axle and travel time at toll tariff adjustment),
- Transport infrastructure development – environmental aspect (infrastructure equipment with alternative energy filling stations, highway network, municipal ring-roads development, development of low-emission zone,

**EKON – economic area:**

- Macro-economic aspect (development of macro-economic indicators, e.g. inflation growth, currency rate development).
- Goods damage relating costs (damage occurred in freight manipulation, theft, vandalism),
- Employee relating costs (wage requirements of employees, fluctuation, failed work performance),
- Customer relating costs (outstanding claims growth, transport operators´ responsibility for damages),
- Competition relating costs (pressure to price reduction, service differentiation),
- Market entering and leaving relating costs (capital demands in car fleet and other facilities acquisition, costs relating to leaving the sector),
- Legislation in the economic area – introducing transport technologies (introducing e-CMR in the Czech Republic, more extensive use of e-documents, etc.),
- Legislation in the economic area – fees (internalisation of external costs),
- Legislation in the economic area – taxes (changes in legislation on property, income and other taxes in the Czech Republic),
- Legislation in the economic area – administration (reduction of oversize administration for transporters),
- Transport infrastructure – economic area (traffic congestions, delayed deliveries, detours, impassable roads),

**S – Social area**

- Legislation in the social area – night travel (remove noise at night, take a driver´s bio-rhythm in consideration),
- Legislation in the social area – drivers (employment relations including abroad (transit travel, compulsory drive breaks),
- Legislation in the social area – foreign countries (legislation limitations in exporter and importer´s countries),
- Development of transport infrastructure – social area (increase of service accessibility for drivers, safe and protected parking lots (ITS – information and reservations service), support to construction of lay-bys and parking places),

- Education and qualification of drivers (specialised training, educational programmes compulsory training, life-long learning),
- Social aspects, healthcare problems – drivers (ageing, high work stress, health problems, frequent overtime work),
- Social influence in the external environment – accident rate,
- Social influence in the internal environment – infectious diseases.

## 4.2 Selection of methods for search and evaluation of risk factors based on the theoretical background

In connection with the transport policy of the Czech Republic, a transport operator´s management needs to sufficiently evaluate its close and remote environment and changes to occur as a result of the transport policy execution. For this purpose, the author selected strategic analysis methods focusing on macro-environment and micro-environment of a company. Sample case studies have been processed enabling a closer explanation of the selected methods in link to a road freight transport operating company:

- SLEPTE, MAP and ETOP methods in the analysis of macro-environment of a road freight operator
- The Porter model of 5 strengths for the analysis of competition of a small-size road freight transport operator,
- Customer satisfaction analysis (as part of BSC).

Regarding the fact that external influence can reflect in the use of company resources and create risky situation inside a company, the dissertation indicates financial analysis as a suitable method to assess financial health, and methods for risk analysis in road freight operating companies, i.e. Failure Mode and Effect Analysis (FMEA) and FTA – Fault Tree Analysis, together with their sample use.

Methods to evaluate risk factors and expression of the scope of their influence are determined according to the evaluator´s requirements; however, they must be limited by the scope and quality of information s/he disposes of. Selected methods were divided according to the following criteria:

1. Situation for the management´s decision making – type of information they dispose of, level of certainty to forecast the future development – methods for decision making under uncertain or risky situation,
2. Types of criteria and their evaluation methods – quantitative and qualitative methods,
3. Affinity to a group – is it possible to assign a particular value to each criterion and optionally also the group affinity,
4. When software simulation is required, then Monte Carlo method,
5. When it is needed to analyse an assessed quantity sensitivity to the risk factor (or factors) – sensitivity analysis.

When evaluating individual risk factors influence, we have to take in consideration whether the decision making is made under uncertain or risky condition. The author accentuates the decision making in risky conditions; however, the methods relating to uncertainty have also been briefly described. Application

of the selected methods is again demonstrated on examples in connection to the needs of road freight transport operators:

- Application of risk matric in a transport company,
- Application of the scoring method, serial method, pair comparison method and Saaty method in the construction and calculation of the Customer Satisfaction Indicator,
- Assessment of a transport operator´s position of among its major competitors for the purpose of market loss risk elimination with the use of a transformation matrix enabling to numerically define partial risk rate in link with the word-expressed risk level and its consequent re-transformation,
- Example of the Monte Cao simulation method by means of the Crystall Ball I software and an example of sensitivity analysis,
- Application of the semantic differential.

A suitable method enabling summarisation of all the partial analyses is the SWOT analysis. Its application is shown in Example 8 using partial analyses and taking in consideration mainly major risk factors calculated upon semi-structured interviews with managers of the road freight operating companies.

## 4.3 Verification of risk factors and selected methods for their identification and assessment in transport companies

Complementing theoretical knowledge of the previous chapters by practical experience of managers acting on top positions in different Czech transport companies was the main objective of the research presented in the following part of the dissertation. After completion of this objective, the author chose the qualitative research methodology because it helps to formulate a deeper insight into the selected phenomenon; and further, the phenomenology attitude was used. The main data collection method was questioning, a semi-structured interview technique. The work with the obtained data consisted of the following stages:

a) Audio-recording of interviews,
b) In-verbatim transcript of the interviews (104 pages of text),
c) Formation of the content categories or sub-categories based on the data classification,
d) Coding according to the categories – individual categories marked by different colours,
e) Data presentation and interpretation.

The purpose of the semi-structured interviews was to complement the theoretical knowledge indicated in the previous chapters by hands-on experience of the interviewees. This resulted in the formation of the following six partial objectives of the research:

1. Find out the extent to which the respondents get acquainted with the strategic documents in the transport sector in the Czech Republic with the stress on road freight transport,
2. Evaluate the designed number of risk factors which can influence business activities of companies controlled by them,

3. Determine the importance of these risk factors,
4. Identify methods used in transport operating companies controlled by the respondents for risk factor identification and risk assessment,
5. Meet the respondents with further methods suitable for risk identification and assessment possible to apply in road freight transport operating companies,

   Find out whether the proposed methods will be motivating for the respondents.

**Research results:**

**Objective 1**

Summarisation of content analysis of the obtained responses is given in Table 1 which indicates the basic content categories relating to this part of the research, i.e.: Strategic documents in transport in the Czech Republic (blue) and Other documents in transport in the Czech Republic (green).

**Table 1** Knowledge and use of the strategic and other documents according to the respondents´ answers

| | | **Knowledge/Use by respondents** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Document (name abbreviated)** | **Document type** | **R1** | **R2** | **R3** | **R4** | **R5** | **R6** | **R7** | **R8** |
| White book of Transport | strategic | x/N | x/N | x/N | N/N | x/N | ČA/N | N/N | N/N |
| Transport policy CZ | strategic | x/N | ČA/N | x/min | N/N | x/N | ČA/N | N/N | N/N |
| Freight transport concept | strategic | x/N | ČA/N | x/N | N/N | x/N | ČA/N | N/N | N/N |
| Sector strategies in Z | strategic | x/N | N/N | x/min | N/N | x/N | ČA/N | N/N | N/N |
| Operational programme Transport | strategic | x/N | A/N | x/N | N/N | x/N | ČA/N | N/N | N/N |
| EP and Council Regulation (ES) N- 1072/2009 (Eurolicence) | EP Regulation | A/A | A/A | A/A | A/A | A/A | A/A | A/A | A/A |
| Laws and decrees for roads freight transport | Laws, decrees and regulations | A/A | A/A | A/A | A/A | A/A | A/A | A/A | A/A |
| Income and property tax laws | Laws | A/A | A/A | A/A | A/A | A/A | A/A | A/A | A/A |
| CMR Convention | International convention | A/A | A/A | A/A | A/A | A/A | A/A | A/A | A/A |
| AETR (transport outside EU)*, Regulation (ES) N. 561/2006 (domestic and EU transport )* | EP Regulation | A/A | A/A | A/A | A/A | A/A | A/A | A/A | A/A |

A – yes, N – no, ČA – partially yes, min – minimum knowledge, x – not specified
Source: author

**Objective 2 and Objective 3**

Table 2 summarises evaluation of the author-designed set of risk factors where the determined groups associate similar risk factors. Importance of the risk factors was proved and since the verification was made in cooperation with experienced managers, the result is unambiguously positive.

**Table 2** Risk factors resulting from the strategic document in road freight transport

| | Risk factor group | Risk factors (RF) | RF importance | Pos/Neg RF | Opportunity | Threat | RF impact |
|---|---|---|---|---|---|---|---|
| I1 | Intelligent transport systems (ITS) - JSDI (unified transport information system) | Unification of transport reporting in JSDI – current and topical information about traffic flow and speed, detours, accidents, etc., integration of data with the Police, fire departments, Central roads records etc.,improved solution of transport casualties | 7.75 | pos. | X | | +1 |
| I2 | Information and communication technology (ICT) | Provision of information about detours and closures planning sufficiently in advance | 7.75 | pos. | X | | +1 |
| B5 | Information – human factor | Continuous information to road traffic participants about risky behaviour, higher law execution in failing to respect highway regulations (monitoring by Police) | 7.75 | pos. | X | | +1 |
| EKON1 | Macro-economic aspect | Inflation growth, development of currency rate CZK/EUR, road freight transport growth rate | 7.25 | neutr. | - | - | 0 |
| EKON3 | Employee relating cost | Lack of drivers, wage requirements and their enforcement, fluctuation, work performance failures (error rate) | 6.75 | rather neg. | | X | -0.5 |
| S4 | Social area-services for drivers | Increased access to driver services, safe and protected parking places (ITS – information and booking systems, support to lay-by construction and parking places) | 6.5 | pos. | X | | +1 |
| S6 | Social area – drivers | Increased aging of employees, Just-in-time management pressure on drivers, health problems (sitting and vibrations in trucks) frequent overtime work | 6.5 | neg. | | X | -1 |
| EKON5 | Competition-relating cost | Number and ratio of major competitors in the market, scope of differentiation of competitors and services | 6.5 | neg. | | X | -1 |
| EKON 11 | Economic areas – operating costs | Traffic congestions, delayed deliveries, detours, low infrastructure passability | 6.25 | neg. | | X | -1 |
| EKON7 | Legislation in economic area – transport technology costs | Introduction of e-CMR in Czech Republic and increased use of electronic documents, consignment tracking and its compactness, RFID technologies (identification of radio frequency) | 6.25 | rather pos. | X | | +0.5 |
| S2 | Legislation in social area - drivers | Legalised minimum wage for drivers in other countries, compulsory regular breaks, changes to employment relations and hygienic standards | 6 | rather neg. | | X | -0.5 |
| EKON6 | Costs relating to entering and leaving market | Capital demands in car fleet and other equipment acquisition, market leaving relating costs | 5.5 | neutr. | - | - | 0 |
| B2 | Technical road safety – intelligent transport systems ITS | Use of satellite navigation systems for high accident rate sections and driver notification (ITS – support to eSafety applications, eCall, Galileo navigation system) | 5.5 | rather pos. | X | | +0.5 |
| B1 | Technical road safety (incl. technical road safety) | Introduction of telematic applications to increase traffic safety and fluency: speed control in highway system, section speed measuring, systems of vehicle weighing at travel, automatic systems for revealing traffic offences and making drivers liable for them | 4.75 | pos. | X | | +1 |
| B3 | Technical condition of vehicles | Improvement of the legislation framework and state control over MOT | 4.75 | pos. | X | | +1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| EKOL7 | Toll – performance fee for using infrastructure based on the driven km | Adjustment of toll tariffs with the aim of maximum differentiation, improving performance fees taking performance categories in consideration, interoperability of electronic toll systems within EU | 4.5 | rather pos. | X | | +0.5 |
| S5 | Education and training of drivers | Compulsory drivers training, life-long learning, specialised learning programmes (at high schools and vocational schools, universities) | 4.25 | rather pos. | X | | +0.5 |
| EKON2 | Costs relating to damaged goods | Possibility of load manipulation relating damages, theft, vandalism | 4 | neg. | | X | -1 |
| EKON 10 | Legislation in economic area – administration | Reduction of administration in transport operating companies (vehicles registration, MOT, professional certification, hiring labour abroad outside the EU) | 3.75 | rather pos. | X | | +0.5 |
| S3 | Legislation in social area – foreign countries | Legislation limitations in exporter and importer countries | 3.5 | rather neg. | | X | -0.5 |
| EKON9 | Legislation in economic area - taxes | Changes to laws of property and income tax in the Czech Republic | 3.5 | neutr. | - | - | 0 |
| EKOL2 | Emissions reduction | Car fleet renewal (road tax), limited vehicles entry in city centres, legal limits on emissions | 3.25 | rather pos. | X | | +0.5 |
| EKOL3 | Legislation in environment protection – limiting infrastructure operation | Reduced use of lower-class roads by heavy trucks with the aim to keep them on highways and motorways, introduction of infrastructure protecting measures rather than avoiding the fee-subject road by heavy trucks | 3 | neutr. | - | - | 0 |
| S7 | External environment - damages | Accident rate | 2.5 | rather neg. | | X | -0.5 |
| S8 | External environment – health impact | Infectious diseases | 2.5 | rather neg. | | X | -0.5 |
| EKON4 | Customer relating costs | Growth of outstanding claims, transport operators´ responsibility for facts they are unable to influence on terms of transport | 2.25 | neutr. | - | - | 0 |
| EKOL4 | City-logistics | Material supplies by means of distribution centres within city-logistics | 2 | neutr. | - | - | 0 |
| B4 | Technical condition of vehicles – intelligent transport systems ITS | Introduction of communication systems connected with transport infrastructure – modern technologies (i.e. autonomous vehicle control, intelligent parking), support to traveling vehicles diagnostics and data sharing | 2 | pos. | X | | +1 |
| S1 | Legislation in social area – night travel | Optional regulation of night travel by differentiated tariffs (the aim to reduce noise at night), endangering of transport safety in connection with a driver´s biorhythm (micro-sleep, night drive) | 2 | rather neg. | | X | -0.5 |
| EKOL1 | Alternative fuels | Technical engine adjustments, hybrid engines | 1 | neutr. | - | - | 0 |
| EKOL5 | Urban mobility | Special freight transport mode in cities, especially when supplying historical city centres within urban mobility | 0.75 | neutr. | - | - | 0 |
| EKOL8 | Environment protection – infrastructure | Equip infrastructure with filling and charging stations for alternative energies, highways network development, ring-roads construction, formation of low-emission zones | 0.7 | rather pos. | X | | +0.5 |
| EKON8 | Legislation in economic area - fees | Internalisation of external costs, introduction of fees for certain external costs: congestions, road accidents, pollution, noise and global warming | 0.5 | neutr. | - | - | 0 |
| EKOL6 | Logistic centres | Attention to establishment of public logistic centres, increase of multimodal transport: support to services for road transporters in other types of transport (railway), use of hub and spoke technologies | 0.5 | neutr. | - | - | 0 |

Source: Author

The analysis showed that the set of risk factors can be used in the design of a model for identification and assessment of risk factors in road freight transport operating companies in connection with the Transport Policy of the Czech Republic.

**Objective 4**

The addressed managers monitor environment impact in a limited scope only as indicated in Table 3 (results of semi-structured interviews).

**Table 3** Methods used in practice of road freight operating companies

| Respondent | Used methods |
|---|---|
| R1a | Financial analysis, SWOT |
| R2 | Financial analysis, SWOT |
| R3 | SLEPTE, MAP and partially ETOP, financial analysis, SWOT |
| R4 | Cost and revenues analysis |
| R5a | Financial analysis, SWOT |
| R6 | SLEPTE, MAP and partially ETOP, Financial analysis, SWOT, analysis by risk matrices partially |
| R7 | Analyses based on practical experience, not specified |
| R8 | Cost and revenues analysis |

Source: Author

**Objective 5 and Objective 6**

We can summarise that the designed methods for identification and assessment of risk factors have been interesting for the addressed managers. Some of them considered their use in practice and requested examples. Generally, the expressions were positive, despite some methods were seen as too complicated for a small-size company. It is obvious that the size of a company is important; however, the answers also reflect the respondent´s expertise. The results are indicated in Table 4.

**Table 4** Evaluation of utilisation of the designed methods as seen by transport companies´ managers

| Method/ Respondent | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | Points/ % | Sequence |
|---|---|---|---|---|---|---|---|---|---|---|
| SLEPTE, ETOP, MAP | yes | yes | yes | no | X** | yes, partially | yes | no | 4.5/ 64 % | 2 |
| Porter model of 5 forces | yes | no | yes | no | X** | no | yes | no | 3/ 42 % | 3 to 6 |
| FTA | yes | yes, but complicated | X | no | X** | X | no | no | 2/ 29 % | 7 to 8 |
| Risk matrix analysis | yes | yes, but complicated | yes | no | X** | no, too theoretical | no | no | 3/42 % | 3 to 6 |
| Customer satisfaction analysis | no | yes, but complicated | yes | no | X** | no | probably yes | no | 3/42 % | 3 to 6 |
| Fuzzy logic, transformation matrix | yes | yes, but complicated | X | no | X** | no, too complicated | no | no | 2/29 % | 7 to 8 |
| Monte Carlo method and sensitivity analysis | no | yes, but complicated | X | no | X** | no, too complicated | no | no | 1/14 % | 9 |
| Semantic differential | yes | yes | X | no | X** | X | yes | no | 3/42 % | 3 to 6 |
| SWOT | yes | yes | yes | yes* | X** | yes | yes | no | 6/86 % | 1 |

X – no comment, * – with a comment: useful for a large company but not in a small-size one, **– not answered due to time constraints, Source: Author

The designed methods for risk factors identification and for their influence assessment can be involved in the model of identification and assessment of risk factors in road freight transport operating companies in connection with the Transport Policy of the Czech Republic.

## 4.4 Design of a model for risk factors identification in road freight transport operating companies in connection to the Transport Policy of the Czech Republic

The designed model describing the methodology for identification and assessment of risk factors in road freight transport companies talks in account the requirements of the company practice. – information about the risks must be obtained and assessed in sufficient amount and quality so it is possible to determine the importance of risks in a short time and suggest the appropriate measures.

Graphic display of the model is in Figure 1. The model takes in consideration the focus of the analysis designed according to the needs of a relevant road freight operating company management: the left part (green colour) focuses on the external environment analysis, the right part shows the internal environment analysis. Complex analysis is performed using both parts.

The resources used for the analysis determine the amount, structure and content of the information while influencing the methods to be used for the risk factors importance assessment. These methods have been used for the external and internal environment which is demonstrated in the central part of the model. The result of all the analyses is the SWOT analysis which is fully satisfactory at the consideration of the external and internal risk factors; however, it can be a merely partial analysis in the event of preferring either external or internal environment only.

Individual blocks of the model indicate references to the dissertation chapters that describe the appropriate analytical methods and show their application in the examples.

The model is defined by an interrupted line. Regarding the fact that risk management involves further steps, the design is integrated in the overall risk management scheme. Figure 1 also shows further stages of risk management in road freight operating companies involving risk management, i.e. certain measures (including assessment of risk acceptability), and a check of the effectiveness of the taken measures. The aim is to demonstrate how the designed model for identification and assessment of risks contributes to risk management in general.

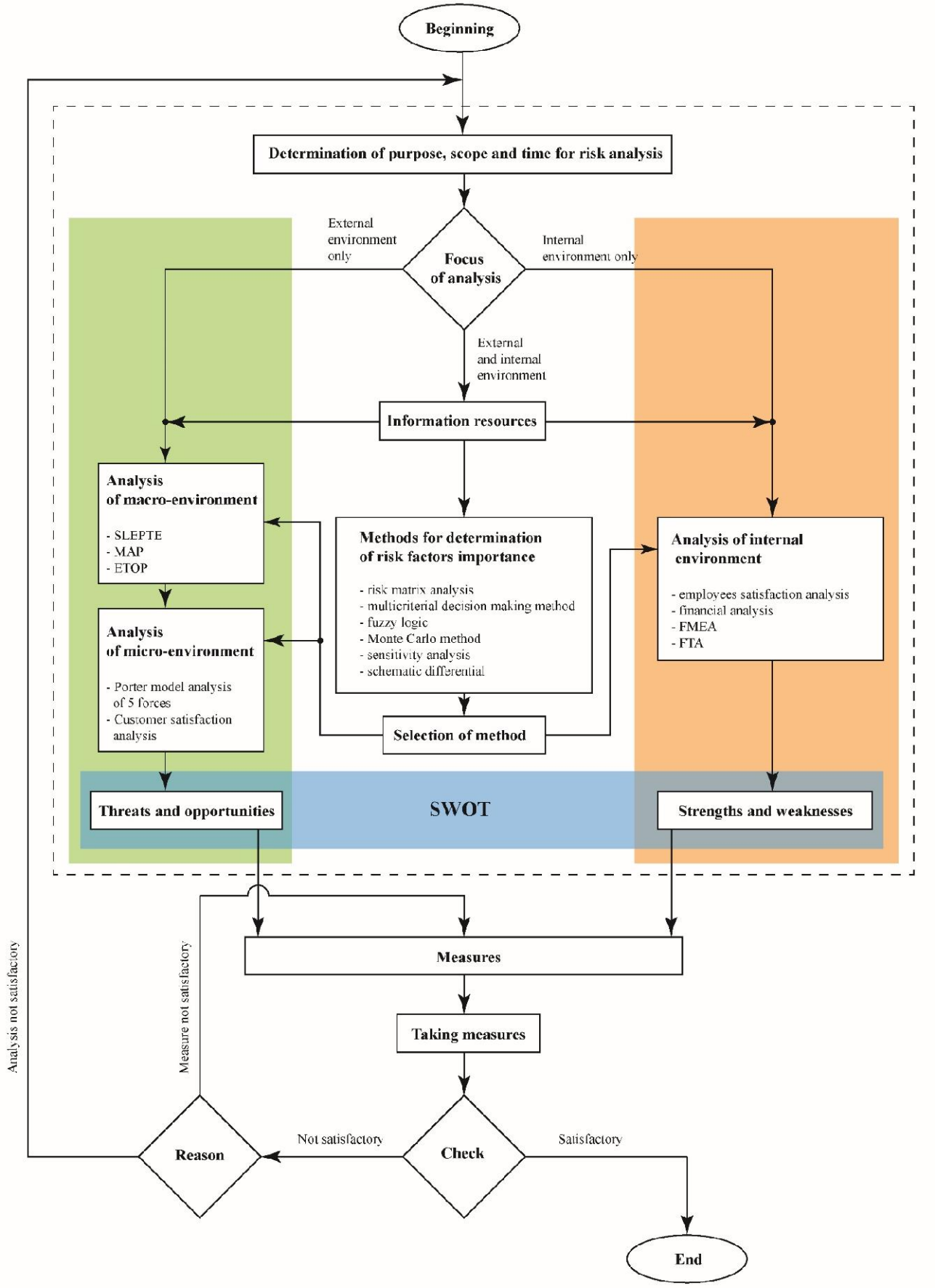


**Figure 1** Model for risk factors identification in road freight transport operating companies in connection to the Transport Policy of the Czech Republic (Author)

# 5 DISCUSSION AND EVALUATION OF RESULTS

The determined risk factors have been verified within semi-structured interviews with experts from road freight transport operating companies. Assignment of risk factors to individual areas therefore respects the theoretical knowledge, and, at the same time, it is a result of a subjective assessment of individual mangers. In regard to their experience, the results reflects the reality.

In overall assessment of the risk factors, opportunities prevail over threats. The research results demonstrated that it is suitable to largely use quantitative approach based on the experts´ opinion knowing that they are simpler, faster and more subjective. A positive result is the finding that the proposed set of methods suitable for identification and assessment of risk factors in freight transport companies was largely accepted by the addressed managers.

It is important to indicate in this chapter the limitations of the quantitative method. Due to time constraints, it was not possible to assess each of the determined risk factors (as it was indicated above, the set contains 111 risk factors), this is why groups of factors have been assessed in the semi-structured interviews. Nevertheless, the respondents gave their opinion as to the factors which influence them most. Detailed assessment of the risk factors for the needs of road freight transport companies´ management can be made with the use of the whole set of risk factors listed in Annex A of the dissertation.

## 5.1 Answers to the research questions

The research further presents answers to the research questions indicated in Chapter 3 of the dissertation.

**Which risk factors can be raised by the transport policy of the Czech Republic in road freight transport operating companies?** Risk factors have economic, social, information and safety character, whose listing is in Annex A. Some of them cannot be unambiguously assigned to a single category because their influence reflects in more areas. Their classification is therefore always subjective on a certain level. Regarding the fact that in risk factors verification in the semi-structured interviews the experts did not contradict the submitted division, the classification can be considered satisfactory.

**Do threats or opportunities prevail in the risk factors assessment in terms of management of the road freight transport operators?** The research shows that opportunities prevail. However, utilisation of individual opportunities must be assessed from the point of view of a particular company.

**How does the Czech transport policy reflect in the internal environment of road freight transport operators?** The respondents asserted that they do not record any direct impact of the transport policy because they do not thoroughly study the strategic document, nor they use them.

## 5.2 The model for identification and assessment of risk factors in road freight transport companies

The objective of the dissertation was to design a model for identification and assessment of risk factors in road freight transport operating companies. The model has been designed and its verification in practice required information about risk factors and their importance for a particular company in terms of the external environment and internal strategic data. From the point of view of a company management, it is very sensitive data which cannot be published. All the addressed owners and managers agreed on publication of their names and names of the companies in the dissertation. All the companies operate in road freight transport; therefore they are competitors to a certain degree, and it is vital to fully respect the importance of their internal information. Verification of the model thus cannot be documented by a concrete, detailed application in a precisely determined company because it is impossible to perform without internal, strategically focused information. However, it is made in the form of a feedback from the experts and proved by an affirmative declaration of the road freight transport companies´ managers.

## 5.3 Benefits of the doctoral thesis

The dissertation describes the current situation of transport, major strategic documents in road freight transport and characterises the transport policy in the Czech Republic in connection with the situation in the European Union with respect to the development trends in road freight transport, including the requirements prescribed to the EU member countries in the given field. This facilitates the completion of the first partial objective and among others, the set of the obtained knowledge can be considered a benefit for the transport companies practice. The current state analysis described the risks, identified their types and risk management methods, which presents the second objective. Consequently, the author described the methods for risk assessment in connection with the reference literature, which completed the third objective. Regarding the fact that classification of methods for risk identification and assessment is varied, the methods have been divided according to the predetermined criteria, which is beneficial in terms of theoretical considerations.

The fourth objective was the determination of risk factor types (risks as opportunities or threats; and their reflection in the economic, social, environmental, safety and information area) and then selection of methods for their identification and assessment suitable for road freight transport operating companies. In connection with the reference literature and especially with the above indicated documents, the author made a list of sectors which present threats and opportunities and identified the risk factors which may negatively or positively affect road freight transport companies. Taking the scientific aspect in consideration, we can positively evaluate the determination of the causal relationships between the transport policy in the Czech Republic and risk factors that have been derived from the strategic documents. The formed set of risk factors is a theoretical benefit in a way enabling to use individual factors as entrance quantities for different analysis of the external environment in road freight transport. A similar set of risk factors has not yet been formed for the needs of these transport operators.

The identified risk factors were submitted to the experts in semi-structured interviews with the aim to verify that the set contains factors with a certain level of importance in road freight transport (which completed the first part of the fifth objective). By means of the formed set it is possible to carry out the risk factors analysis with the view to the Czech transport policy, especially to the differences of a particular road freight transport company. It is therefore generally useful for any company in the given sector: it is a practical benefit. It is possible to use the full set of 111 risk factors or its compressed version where similar factors are associated in groups.

Importance of the identified risk factors has been assessed on the basis of the answers obtained in the qualitative research (semi-structured interviews) and in connection to the Czech transport policy have been identified major opportunities and threats in the environment of the monitored companies. This can be presented as a theoretical advantage (e.g. considering the real situation in different analyses) and in terms of company practice, where the set can be used as a background for analysis carried out in a particular road freight transport company.

In relation to the fourth partial objective, the author determined methods suitable for identification and assessment of risk factors in road freight transport. Firstly, a theoretical set of such methods was formed and consequently submitted to the respondents. The selected methods can be modified; they were followed by a set of examples to facilitate the respondents in assessment of the most suitable ones for the given case. In opinion of the addressed managers, the designed file contains methods which are interesting and useful in their business. A special benefit for teaching theory and for practice is presented in the eight examples involving the use of methods selected for the identification and assessment of risk factors in road freight operating companies. Its benefit was proved by the fact that the examples have been required for the use in some of the addressed companies. The full SWOT analysis was among the most positively received methods. Performing of the qualitative research and its assessment completed all parts of objectives four and five.

The main objective of the dissertation was the model for identification and assessment of risks in road freight transport operating companies in connection with the transport policy of the Czech Republic. The design of the model presents a theoretical and practical benefit. The model is applicable also in companies providing a different transport mode where it is essential to identify the risk factors in terms of their business, which applies to the assessment of their impact.

# CONCLUSION

The knowledge obtained from the reference literature research prove that transport policy documents in the European Union and in the Czech Republic require a thorough determination of objectives leading to the improvement of the overall transport situation and reduction of its negative impact on a society. Management of road freight transport operating companies therefore must pay attention to the strategic documents and

monitor their existing and planned measures accordingly because the requirements reflect the current or future changes in the external environment of transport operators.

The dissertation identifies the aspects of transport policy in the Czech Republic in view of transport operators´ management. This is what differentiates the dissertation from other types of works where the research concentrated on transport policy from the point of view of the state or the public interest.

To reach the objectives, the author described and selected suitable methods for identification and assessment of risk factors. An integral part of the dissertation is the research: questioning made in the form of interviews whose purpose was to specify the risk factors considered most important by the management and to select methods for their identification and assessment. The respondents were owners and managers of major road freight transport operating companies. This is the reason why the interviews lead to a number of interesting findings, sometimes even in excess of the research topic; therefore, they can be used in the follow up research.

The designed model enables a transport company management to react to changes invoked by activities in the transport policy in the Czech Republic (by e.g. their performing or by adjustment of the existing ones) by means of identification of the risk factors resulting from the strategic documents in transport, in particular road freight transport in the Czech Republic, and by assessment of their impact.

The designed model can be used in a company´s practice in road freight transport and its application facilitates prevention of possible threats. On the other hand, it helps to use opportunities resulting from the transport policy changes. Such changes can reflect in the company environment, that is in the strong and weak points of a transport operating company because the model takes into account the internal environment relating analysis. The obtained knowledge can function as a solid background for further research in the field of risk management or in strategic management.

# REFERENCE LITERATURE

AHMED, Ammar, Berman KAYIS a Sataporn AMORNSAWADWATANA, 2007. A review of techniques for risk management in projects: Benchmarking. *International Journal*, Vol. 14, no. 1, p. 22–36. ISSN 1463-5711.

AKYILDIZ, Hakan a Ayhan MENTES, 2017. An integrated risk assessment based on uncertainty analysis for cargo vessel safety. *Safety Science,* Vol. 92, p. 34–43. DOI 10.1016/j.ssci.2016.09.009.

ALLODI, Luca a Fabio MASSACCI, 2017. Security events and vulnerability data for cybersecurity risk estimation [online] [cit.2019-07-15]. *Risk Analysis*, Vol. 37, no. 8, p. 1606–1627. Available from: https://doi.org/10.1111/risa.12864.

BERG, Claudia N., Uwe DEICHMANN, Yishen LIU a Harris SELOD, 2017. Transport Policies and Development [online] [cit.2019-06-19]. *Journal of Development Studies*, Vol. 53, no. 4, p. 465–480. Available from: https://doi.org/10.1080/00220388.2016.1199857.

BLAŽEK, Ladislav, 2014. *Management: organizování, rozhodování, ovlivňování.* 2nd edition. Prague: Grada, 211 p. ISBN 978-80-247-4429-2.

COITO, Esteban, Benjamin KLAUS a Wilhelm BLASER, 2020. Společná dopravní politika: obecné zásady [online] [cit. 2020-04-12]. *European Parliament*. Available from: https://www.europarl.europa.eu/factsheets/cs/sheet/123/spolecna-dopravni-politika-obecne-zasady.

COOPER, Dale F. a kolektiv, 2004. *Project risk management guidelines: managing risk in large project and complex procurements.* New York: Wiley, 401 p. ISBN 0-470-02281-7.

EISLER, Jan, 2005. *Ekonomika dopravních služeb a podnikání v dopravě*. Prague: Oeconomica, 151 p. ISBN 80-245-0772-2.

EUROPEAN COMMISSION, 2019. Transport in the European Union Current Trends and Issues – 2019 [online] [cit. 2020-03-16]. *European Commission*. Available from: file:///C:/Users/uzivatel/AppData/Local/Microsoft/Windows/Temporary%20Internet%20Files/Content.IE5/6OHJYCS7/2019-transport-in-the-eu-current-trends-and-issues.pdf.

EUROPEAN COMMISSION, 2020. Mobility Strategy: A fundamental transport transformation – Commission presents its plan for green, smart and affordable mobility [online] [cit. 2020-12-27]. *European Commission*. Available from: https://ec.europa.eu/transport/themes/mobilitystrategy_en.

EUROPEAN ECONOMIC FORECAST SUMMER, 2020. European Economy Institutional Papers 132 [online] [cit. 2020-04-18]. *EU*. Luxembourg: Publications Office of the European Union. ISSN 2443-8014. Available from: https://ec.europa.eu/info/business-economy-euro/economy-finance-and-euro-publications_en.

EUROSTAT, 2019. Energy, transport and environment statistics [online] [cit. 2019-12-16]. *EU.* Luxembourg: Publications Office of the European Union, 217 p. ISBN 978-92-76-10971-6, ISSN 2363-2372, DOI 10.2785/660147 KS-DK-19-001-EN-N Ed. Available from: https://ec.europa.eu/eurostat/documents/3217494/10165279/KS-DK-19-001-EN-N.pdf/76651a29-b817-eed4-f9f2-92bf692e1ed9.

EUROPEAN UNION, 2020. European Structural and Investment Funds [online] [cit. 2020-06-20]. *Operational Programme Transport.* Available from: https://www.opd.cz/slozka/Operacni-program-Doprava-2021.

FOTR, Jiří a Jiří HNILICA, 2014. *Aplikovaná analýza rizika ve finančním managementu a investičním rozhodování.* 2nd updated eddition. Prague: Grada, 299 p. ISBN 978-80-247-5104-7.

FOTR, Jiří, Ivan SOUČEK, Miroslav ŠPAČEK, Stanislav HÁJEK a Emil VACÍK, 2012. *Tvorba strategie a strategické plánování*. 2nd eddition. Prague: Grada, 384 p. ISBN 978-80-247-3985-4.

GOERLANDT, Floris, Nima KHAKZAD a Genserik RENIERS, 2017. Validity and validation of safety-related quantitative risk analysis [online] [cit. 2020-02-16].: *Safety Science*, Vol. 99, part B, p. 127–139. Available from: https://doi.org/10.1016/j.ssci.2016.08.023.

GUL, Muhammet a Muhammet Fatih AK, 2018. A comparative outline for quantifying risk ratings in occupational health and safety risk assessment [online] [cit. 2020-01-16]. *Journal of Cleaner Production*, Vol. 196, no. 20, p. 653–664. Available from: https://doi.org/10.1016/j.jclepro.2018.06.106.

HAIMES, Yacov, Y., 2009 On the Complex Definition of Risk: A Systems-Based Approach [online] [cit. 2015-03-12]. *Risk Analysis*, Vol. 29, no. 12, p. 1647–1654. Available from: https://doi.org/10.1111/j.1539-6924.2009.01310.x.

HITTMÁR, Štefan, 2006. *Manažment.* Žilina: EDIS – vydatel'stvo ŽU, 299 p. ISBN 80-8070-558-5.

KHLIF, Hichem a Khaled HUSSAINEYC, 2014. The association between risk disclosure and firm characteristics: a meta-analysis [online][cit2020-01-08]. *Journal of Risk Research*, Vol. 19, no. 2, p. 181–211,

DOI 10.1080/13669877.2014.961514. Available from: http://www.tandfonline.com/doi/abs/10.1080/13669877.2014.961514.

MINISTRY OF TRANSPORT OF THE CZECH REPUBLIC, 2013a. Dopravní politika ČR pro období 2014 – 2020 s výhledem do roku 2050 [online] [cit. 2015-04-02], *Ministry of Transport of CR*, 89 p. Available from: http://www.mdcr.cz/NR/rdonlyres/6771FC27-DCCC-4B72-BD0E-EF7E6118704/0/Dopravnipolitika20142020schvalena.pdf.

MINISTRY OF TRANSPORT OF THE CZECH REPUBLIC, 2013b. Operační program Doprava 2014-2020. [online] [cit. 2015-08-15]. *Ministry of Transport of the CR*. Available from: http://www.opd.cz/cz/OP_doprava_2014-2020.

MINISTERSTVO DOPRAVY ČR, 2017. Koncepce nákladní dopravy pro období 2017-2023 s výhledem do roku 2050 [online] [cit. 2019-07-20]. *Ministerstvo dopravy ČR*. Dostupné z: http://https://www.mdcr.cz/Dokumenty/Strategie/Koncepce-nakladni-dopravy-pro-obdobi-2017-2023-s-v.

MINISTRY OF TRANSPORT OF THE CZECH REPUBLIC, 2020a. Bílá kniha – Plán jednotného evropského dopravního prostoru – vytvoření konkurenceschopného dopravního systému účinně využívajícího zdroje [online] [cit. 2020-07-12]. *Ministry of Transport of the CR*. Available from: https://www.mdcr.cz/Dokumenty/Evropska-unie/Zakladni-dokumenty/Bila-kniha-Plan-jednotneho-evropskeho-dopravniho.

MINISTRY OF TRADE AND INDUSTRY OF THE CZECH REPUBLIC, 2020. Analýza vývoje ekonomiky ČR – leden 2020 [online] [cit. 2020-03-20]. *Ministry of Trade and Industry of the CR*. Available from: https://www.mpo.cz/cz/rozcestnik/analyticke-materialy-a-statistiky/analyticke-materialy/analyza-vyvoje-ekonomiky-cr-leden-2020--252518/.

MOLNÁR, Zdeněk a kolektiv, 2012. *Pokročilé metody vědecké práce.* Prague: Profess Consulting, 170 p. ISBN 978-80-7259-064-3.

NAVRÁTILOVÁ, Alena, Naděžda ROZMANOVÁ a kolektiv, 2016. Principy a pravidla územního plánování: internetová příručka –: Principy a pravidla územního plánování. Kapitola C – Funkční složky C.7 Dopravní infrastruktura [online][cit2018-06-08]. Brno: *Ústav územního rozvoje*. poslední aktualizace vybraných kapitol ke dni 23. 3. 2016. Available from: http://www.uur.cz/default.asp?ID=2571).

NÆVESTAD, Tor-Olaf, PHILLIPS, Ross Owen, ELVEBAKK, Beate, 2015. Traffic accidents triggered by drivers at work – A survey and analysis of contributing factors [online][cit2020-01-10]. *Transportation Research Part F: Traffic Psychology and Behaviour*, No 34, p. 94–107. Available from: https://doi.org/10.1016/j.trf.2015.07.024.

NEUGEBAUER, Tomáš, 2017. Metoda JBM [online][cit. 2020-06-08]. JBM *Method*. Available from: http://bozppo-neu.cz/?page_id=755.

ORAVA, František, 2012. Logistická doprava [online][cit2015-01-03]. *Acta Logistica Moravica*, Vol. 2012, no. 1, p. 81–90. ISSN 1804-8315. Available from: http://web2.vslg.cz/fotogalerie/acta_logistica/2012/1-cislo/9-orava.pdf.

OSTROM, Lee, T. a Cheryl, A. WILHELMSEN, 2019. *Risk assessment: tools, techniques, and their applications*. USA: Hoboken, New York: Wiley, 592 p. ISBN 978-1119483465.

PASMAN, Hans, J., William J. ROGERS, a M. Sam MANNAN, 2017 Risk assessment: What is it worth? Shall we just do away with it, or can it do a better job? *Safety Science,* No. 99, p. 140–155. DOI 10.1016/j.ssci.2017.01.011.

PYKHTIN, Kirill, Tatiana SIMANKINA, Vladimir SHARMANOV a Anna KOPYTOVA, 2017. Risk-based approach in valuation of workplace injury rate for transportation and construction industry. *IOP Conference Series: Earth and Environmental Science, Energy Management of Municipal Transportation Facilities and Transport – EMMFT 2017,* No. 90, p. 10–13, Far Eastern State Transport University, Russian Federation. DOI 10.1088/1755-1315/90/1/012065.

RODRIQUE, Jean-Paul, 2020. *The Geography of Transport Systems*. New York: Routledge, 456 p. ISBN 978-0-367-36463-2.

ŘEZANKOVÁ, Hana, 2011. *Analýza dat z dotazníkových šetření*. 3rd eddition. Prague: Professional, 223 p. ISBN 978-80-7431-062-1.

SMITH, Andrew, P. A., 2016. UK survey of driving behaviour, fatigue, risk taking and road traffic accidents. *BJM Open*, Vol. 6, no. 8, p. 8, DOI 10.1136/bmjopen-2016-011461.

TAYLOR, J. Robert, 2016. Can process plant QRA reduce risk? – Experience of ALARP from 92 QRA studies over 36 years. *Chemical Engineering Transactions,* Vol. 48, p. 811–816. DOI 10.3303/CET1648136.

VOCHOZKA, Marek a Petr MULAČ, 2012. *Podniková ekonomika. Finanční řízení*. Prague: Grada, 570 p. ISBN 978-80-247-4372-1.

# AUTHOR'S PUBLICATIONS

HAŠEK, Jakub, Jiří KOZLOVSKÝ a Iveta MYŠKOVÁ, 2013. Vývoj a trendy v bezpečnosti dopravy v kontextu dopravní politiky. In: *Sborník příspěvků virtuální konference Aktuální trendy v dopravě a ekonomice 2013* [CD]. Pardubice: Univerzita Pardubice, s. 283-298. ISBN 978-80-86530-90-1.

MYŠKOVÁ, Iveta, 2013. Porovnání konkurenceschopnosti silniční a železniční dopravy z pohledu zákazníka. In: *Sborník příspěvků virtuální konference Aktuální trendy v dopravě a ekonomice 2013* [CD]. Pardubice: Univerzita Pardubice, s. 166-176. ISBN 978-80-86530-90-1.

MYŠKOVÁ, Iveta a Vlastimil MELICHAR, 2013. Podnikání v dopravě. In: *Zborník z virtuálnej MVK organizovanej pri príležitosti Týždňa vedy* [CD]. s. 188-195. ISBN 978-80-225-3754. Výstup z virtuální konference: Podnikanie – pedagogické a vedecké aspekty jeho uplatnenia v praxi.

MYŠKOVÁ, Iveta, Vlastimil MELICHAR a Ivo DRAHOTSKÝ, 2014. Strategic Objectives of Transport Enterprise in Relation to the Requirements of Transport Policy in the Application of the Balanced Scorecard Method. In: *Proceedings of the 1st CER Comparative European Research Conference – International Scientific Conference for PhD Students of EU Countries* [CD]. London: Sciemcee, s. 36-39. ISBN 978-0-9928772-0-0.

MYŠKOVÁ, Iveta a Vlastimil MELICHAR, 2014. Využití Fuzzy logiky při rozhodování managementu. In: *Recenzovaný sborník příspěvků interdisciplinární mezinárodní vědecké konference doktorandů a odborných asistentů QUAERE 2014*. Hradec Králové: Magnanimitas, s. 50-58. ISBN 978-80-87952-04-7.

OBORILOVÁ, Iveta a Vlastimil MELICHAR, 2014. Analysis and Comparison of the Transport Situation in Norway and in the Czech Republic. In: *Proceedings of the 2nd Biannual CER Comparative European Research Conference* [CD]. London: Sciemcee, s. 52-55. ISBN 978-0-9928772-2-4.

OBORILOVÁ, Iveta a Vlastimil MELICHAR, 2014. Využití EHP a Norských fondů pro rozvoj dopravy v České republice. In: *Sborník příspěvků Mezinárodní Masarykovy konference pro doktorandy a mladé vědecké pracovníky 2014* [CD]. Hradec Králové: Magnanimitas, s. 1067-1076. ISBN 978-80-87952-07-8.

MYŠKOVÁ, Renáta a Iveta OBORILOVÁ, 2015. Sociální aspekty společenské odpovědnosti a jejich hodnocení v dopravních podnicích. In: *Recenzovaný zborník vedeckých prác z Medzinárodnej vedeckej konferencie Aktuálne problémy podnikovej sféry 2015* [CD]. Bratislava: Ekonomická univerzita v Bratislave, Fakulta podnikového manažmentu, p. 462-472. ISBN 978-80-225-4077-3.

OBORILOVÁ, Iveta a Vlastimil MELICHAR, 2015. Economic Impacts of Transport Policy Measures of the Czech Republic in terms of Transport Enterprises. In: *SGEM 2nd International Multidisciplinary Scientific Conferences on Social Sciences and Arts Proceedings*. Bulgaria: STEF92 Technology Ltd. Sofia Bulgaria, book 2, volume 3, p. 211-218. ISSN 2367-5659.

MYŠKOVÁ, Renáta a Iveta OBORILOVÁ, 2015. Strategic Analysis of the External Environment of Transport Companies in the Czech Republic. In *SGEM 2nd International Multidisciplinary Scientific Conferences on Social Sciences and Arts Proceedings*. Bulgaria: STEF92 Technology Ltd. Sofia Bulgaria, book 2, volume 3, p. 755-762. ISSN 2367-5659.

OBORILOVÁ Iveta, Klára LUSTIGOVÁ, Ivo DRAHOTSKÝ a Vlastimil MELICHAR, 2015. What-If Analysis as a Tool Used in the Decision Making and Risk Management. In *Sborník Dopravní konference a VI. Mezinárodní vědecké konference 2015*. Pardubice, p. 405-414. ISBN 978-80-7395-924-1.

OBORILOVÁ Iveta, Renáta MYŠKOVÁ a Vlastimil MELICHAR, 2015. Risks Associated with the Human Resources Management in Transport Companies. In: P*rocedia Economics and Finance* [online]. UK. Vol. 34, p. 352–359. DOI 10.1016/S2212-5671(15)01640-8. Available from: http://authors.elsevier.com/sd/article/S2212567115016408.

MYŠKOVÁ Renáta a Iveta OBORILOVÁ, 2016. Analýza rizik v sociálně pracovní oblasti v praxi malého podniku. In *Mezinárodní vědecká konference Ekonomika, financie a manažment podniku - rok 2015.* Bratislava: Vydavateľstvo Ekonóm, 2016. p. 740-748. ISBN 978-80-225-4280-7.

OBORILOVÁ Iveta a Vlastimil MELICHAR, 2016. Strategic documents in transport and their importance for strategic analysis of transport companies. In *Mezinárodní vědecká konference Žilinské univerzity CMDTUR 2016,* Žilina, p. 302-312. ISBN 978-80-554-1265-8.

OBORILOVÁ, Iveta a Renáta MYŠKOVÁ, 2017. Vybrané metody strategické analýzy v praxi dopravního podniku. In *Current Problems of the Corporate Sector 2017*. Bratislava: Vydavateľstvo Ekonóm, 2017. p. 823-831. ISBN 978-80-225-4422-1.