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Risk analysis in transport and logistics

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Abstract

Globalization and production concentration have led to more efficient supply chain networks, which has led to the emergence of different types of risks. Although most companies have implemented special risk management programs, there may be events that can not be controlled by businesses, and unwanted consequences are not delayed.
The reason I chose the title "Risk Analysis in Transport and Logistics" is that I noticed the increasing importance of transport and logistics in the last period.
The purpose of this work is to determine the impact of risks in transport and logistics activity, and for that has been achieved a desk research, in which I have analyzed the statistical data from 2016, regarding transport services in Romania.
I think that this paper will be useful for all who want to understand the significance impact of risks in transport and logistics activity, representing a suitable source of information in this area.

Keywords: transportation, logistics, risks, analysis

JEL Classification: L81, L91, R41

1. Introduction

I believe that Europe must have competitive transport systems to allow international competition in order to generate economic growth, create jobs and improve the quality of life of the population.

Globalization and production concentration have led to more efficient supply chain networks, which has led to the emergence of different types of risks.

Although most companies have implemented special risk management programs, there may be events that can not be controlled by businesses, and unwanted consequences are not delayed.

I agree with the statement that transport networks and global supply chains are the backbone of the world economy (European Commission, 2014), as they support economic development.

2. Presenting the risks with impact on the activity of a transport and logistics company

Below I presented the three global risks (World Economic Forum, 2016) that I considered to be representative of the transport industry:

2.1 Risk of Romania's infrastructure

The lack of adequate transport infrastructure can stifle development, and the regional economy is stagnating or even regressing. Difficult access (measured in time and cost) to areas with economic, residential or leisure functions of a region makes that region less attractive for both the business and the population.

The high freight transport costs (whether we are talking about raw materials, semi-finished products or finished products) and the difficult movement of people in a certain area are factors that discourage economic investment and lead to gradual pre-loading of that area (Treaty on the Functioning of the European Union, 2007).

In my opinion, one of the most important factors influencing transport activity at national level is infrastructure. In fact, the more developed and modern infrastructure is, the more the transport sector has to gain and prosper.

So, in order to calculate the probability of having more new km of motorway in 2017, I chose to analyze the new *km of motorway achieved / year.*

Table 1 - Analysis of the new km of highway in 2009-2016 period

Year n	Highway - km	New highway Km/year	n/n-1
2009	321	40	-
2010	332	11	-29
2011	350	18	7

2012	550	200	182
2013	644	94	-106
2014	683	39	-55
2015	747	64	25
2016*	*843*	*96*	*32*
2017*	*944*	*101*	*5*

Source: Own processing based on data obtained from insse.ro

* Forecast data using the Excel formula, Forecast.

$$P= 4 / 7 * 100 = 57,14\% \qquad (1)$$

Figure 1. Absolute change in the number of new highway km in 2009-2016
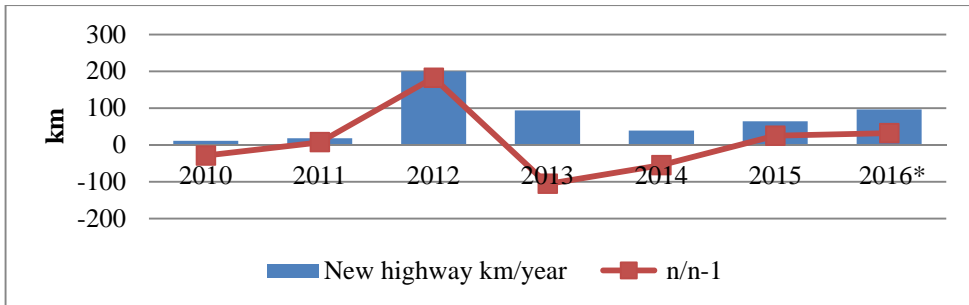
Source: Own processing based on data obtained from insse.ro

According to Table 1 and Figure 1, the probability that the number of new highway km achieved in 2017 will increase compared to the previous year is 57.14%. From a negative perspective, there is a probability of 42.86% that the number of new kilometers achieved in 2017 will decrease compared to 2016. In conclusion, the probability of a higher increase in the number of new highways is in favor of the national economy and, implicitly, the transport sector.

At first glance, transport companies have gained in terms of being able to respect a promised transit time to customers, reduce fuel consumption and reduce the risk of damage to fleets.

2.2 Risk of illicit trade

Carriers may be tempted to engage in smuggling activities. The legislation in force (Customs Code of Romania, Law 86/2006) states that the introduction or removal from the country of any goods or merchandise through places other than those established for customs control constitutes the smuggling offense and is punished by imprisonment from 2 to 7 years and the prohibition of certain rights.

The second risk with a significant national impact on the transport sector is illicit trade, which I analyzed in the following table, using statistical data on the number of import-export and smuggling offenses during the period 2006-2016.

Table 2 - Analysis of import - export and smuggling offenses during 2006-2016

Year (n)	No. of import - export and smuggling offenses	n/n-1 %
2006	230	-
2007	332	44%
2008	348	5%
2009	541	55%
2010	839	55%
2011	692	-18%
2012	614	-11%
2013	686	12%
2014	1038	51%
015*	1006	-3%
2016*	1080	7%
2017*	1153	7%

Source: Own processing based on data obtained from insse.ro

* Forecast data using the Excel formula, Forecast.

$$P = 3 / 10 * 100 = 30 \% \quad (2)$$

Figure 2. Evolution of import - export and smuggling offenses during 2006-2016
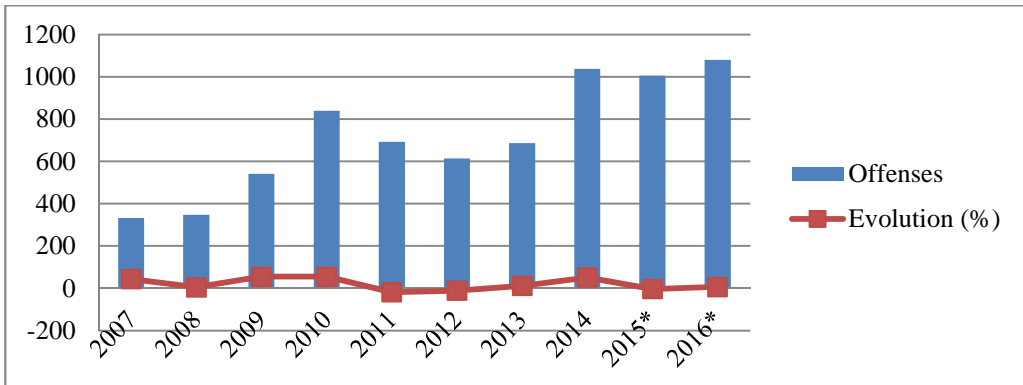
Source: Own processing based on data obtained from insse.ro

According to Table 2 and Figure 2, the probability that the number of offenses incriminated in special laws - smuggling and import-export offenses in 2017 will drop compared to the previous year is 30%.

Transport companies are at risk because the chances of the number of crimes falling in 2017 are rather low but realistic because this is difficult to control by company management, which should focus on implementing preventive measures for employees who make use of such actions. The state also has a rather important role to play in implementing and supporting these measures.

2.3 Floods in Romania

Therefore, a national risk affecting the national economy is represented by floods. In order to assess the probability of this risk, I chose to analyze the number of hydrographic warnings between January and November 2016, as the phenomena covered[1] by these warnings are: significant leaks on the slopes, torrents and streams, rapid floods on small rivers with possible flood effects and increases in flows and levels on some rivers, with possible overtaking of defense quotas. In summary, these warnings present the areas where floods are most likely to occur.

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[1] **Institutul Național de Hidrologie și Gospodărire a Apelor -** http://www.inhga.ro/-/avertizare-hidrologica-nr-38-din-02-06-2016

Table 3 - Analysis of hydrological warnings in January-November 2016

Year - 2016	No. of hydrological warnings
January	5
February	3
March	14
April	5
Mai	6
June	16
Iuly	4
August	0
September	2
October	5
November	1

Source: Own processing based on data obtained from http://www.inhga.ro/warnings[2]

a) *What is the probability that the number of hydrological warnings will appear in 2017?*

$$P= 10/11 * 100 = 90,91\% \quad (3)$$

b) *What is the probability that in 2017 the number of* hydrological warnings *will be above the average of 2016?*

Average = 61 hydrological warnings */ 11 months= 5.55* hydrological warnings

$$P = 3 / 11 * 100 = 27,27 \% \quad (4)$$

Unfavorable climatic conditions have a significant impact on all modes of transport and the consequences are on both the infrastructure and the fleet of vehicles but also on the persons directly or indirectly involved. On the other hand, in addition to the material damage produced indirectly, indirect losses are caused by the delays caused by these extreme conditions, which hinder traffic.

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[2] **Institutul Național de Hidrologie și Gospodărire a Apelor -** *http://www.inhga.ro/warnings*

3. The analisys of a transport and logistics company risks

Concerning the applicative part of this work, I chose to conduct an analysis about a transport and logistics company risks, as follows:

3.1 Research methodology

The project was based on the research question: What is the impact of risks in transport and logistics activity?

In order to answer to this question, I have tried to achieve the following objectives:

1. Determining the most important risks that affect this activity;

2. Establish the impact of these risks in a transport and logistics company;

3. Identify the effects of these risks in transport and logistics activity;

This paper is the result of the research of risks from this domaine and I did this analize through Excel.

3.2. Analysis and interpretation of research results

Regarding the first risk (Risk of Romania's infrastructure), I want to know which is the influence of the new highway km regarding the delay rate for internal transport orders, so, for that I had used the following variables: **New highway km/year - independent variable** and **Delay rate (%) - dependent variable.**

Table 4 - New highway km vs. the delay rate for internal transport orders

Year	New highway - Km/year	Delay rate (%)
2010	11	3
2011	18	2.9
2012	200	2.7
2013	94	2.8
2014	39	2.6
2015	64	2.5
2016*	*96*	*2.2*

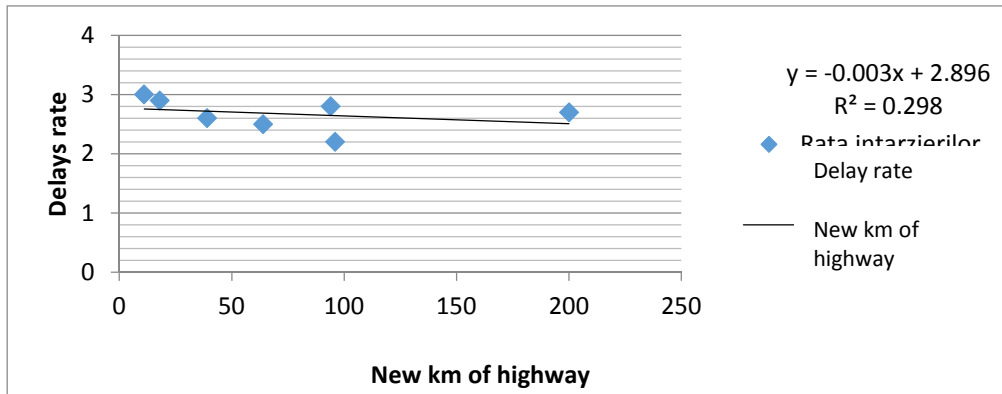| 2017*	101	2.17

Source: Own processing based on data obtained from insee.ro and from analized company

* Forecast data using the Excel formula, Forecast.

Next, I chose to determine the regression model appropriate to the analysis of the link between the two variables and graphically represent the data through a correlogram.

Figure 3 - Risk 1 Correlogram

Source: Own processing with Excel, based on data obtained from analized company

As can be seen in Figure 3, between the number of new highway kilometers and the delays rate, there is a linear, inverse connection.

The regression equation: y = -0.003x + 2.896

2.896 => free term, represents the intersection point between OY and the regression line y;

-0.003 < 0, => the connection between the new highway and the delays rate is the reverse. At a 1 km rise in the km of highway, there is a decrease in the delay rate by 0.003;

R² = 0.298 => the number of new highway kilometers influences the delays rate by 29.8%, the remaining up to 100% being the influence of other factors. Therefore, if the no. of km will increase, the rate of delays will decrease in 2017, as forecast in table no. 4.

In order to establish what is the impact of the number of smuggling and import / export delays for international freight transport orders under EXW, I had

used the following variables: **number of offenses / year - independent variable** and **number of delayed orders - dependent variable.**

Table 5 - Number of offenses vs. number of delays

| Year (n)	Number of offenses / year	Number of IFF EXW delayed orders
2010	839	720
2011	692	640
2012	614	578
2013	686	530
2014	1038	770
2015	1006	937
*2016***	*1080*	*839*
*2017***	1104	880

Source: Own processing based on data obtained from insse.ro and analized company

* Forecast data using the Excel formula, Forecast.

*IFF=International freight forwarder and EXW - door-to-door delivery

Next, I chose to determine the regression model appropriate to the analysis of the link between the two variables and graphically represent the data through a correlogram:

Figure 4 - Risk 2 Correlogram
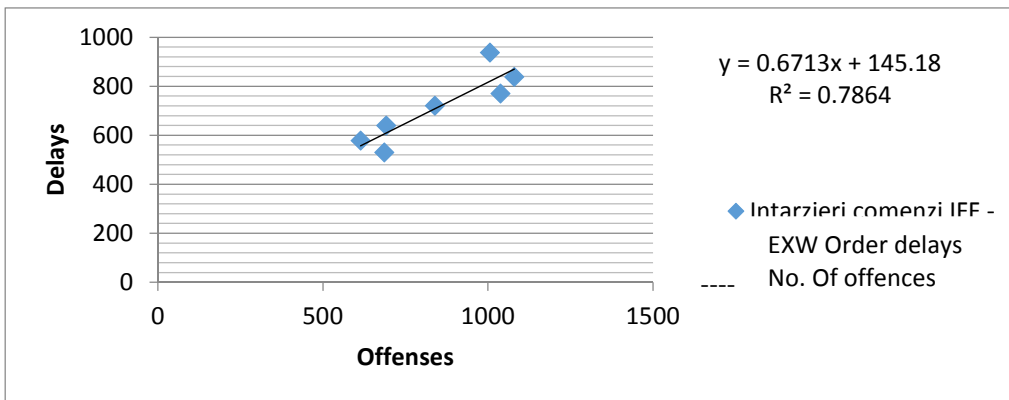
Source: Own processing with Excel, based on data obtained from analized company

As can be seen in Figure 4, between the number of offenses and the number of delays, there is a linear direct connection.

The regression equation: y = 0.671x + 145.1

145.1=> free term, represents the intersection point between OY and the regression line y;

0.671 > 0, =>=> the connection between the no. of offences and the delays rate is directe, so with an increase in the number of offenses, there is an increase in the number of delays by 0.671;

R² = 0.786 => the number of smuggling and import / export offenses influence the number of delays by 78.6%, the remaining up to 100% being the influence of other factors. Therefore, if the number of offenses increases, the number of delays will increase in 2017, as predicted in table no. 5.

How does the number of hygrologic alerts influence the number of delivery orders delivered within the set deadline?

Table 6. No. of hydrological alerts vs. no. of orders delivered in time

2016	No. of hydrological alerts	No. of orders delivered in time
January	5	1648
February	3	2378
March	14	3020
April	5	3425
Mai	6	3074
June	16	2830
Iuly	4	4564
August	0	7273
September	2	7294
October	5	6766
November	1	8798

Source: Own processing based on data obtained from company

Next, I chose to determine the regression model appropriate to the analysis of the link between the two variables and graphically represent the data through a correlogram:

Figure 5 - Risk 2 Correlogram
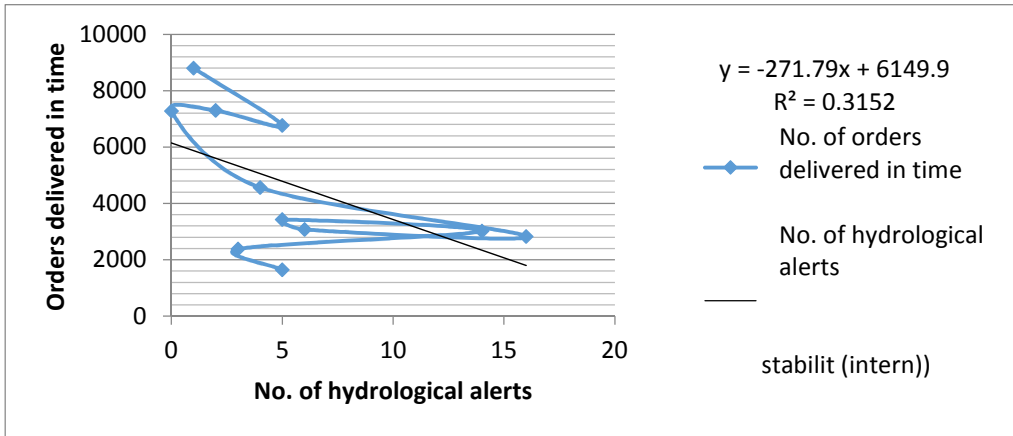
Source: Own processing with Excel, based on data obtained from analized company

As can be seen in Figure 5, there is an inverse linear relationship between the number of offenses and the number of delays;

The regression equation: y = -271.7 x + 6149

6149=> free term, represents the intersection point between OY and the regression line y;

-271.7 < 0, => the link between the hydrological alerts and no. of orders delivered in time is inverse. An increase by one the number of alerts, causes a decrease in the number of orders delivered on time with 271.7 orders.

R² = 0.315 => the number of hydrological alerts influences the number of delays in the proportion of 31.5%, the remaining up to 100% being the influence of other factors.

In this analysis, I believe that modeling errors have occurred, by way of applying the tests, errors of appreciation in what the type of distributions are chosen, user-related errors, but also the interpretation of the results.

4. Conclusions

In conclusion, a transport and logistics company is affected by a lot of risks. Thus, the number of new highway kilometers influences the delays rate by 29.8%, the remaining up to 100% being the influence of other factors. Therefore, if the no. of km will increase, the rate of delays will decrease in 2017.

Also, I found that the number of smuggling and import / export offenses influence the number of delays by 78.6%, the remaining up to 100% being the influence of other factors.

So, if the number of offenses increases, the number of delays will increase in next year and, the number of hydrological alerts influences the number of delays in the proportion of 31.5%, the remaining up to 100% being the influence of other factors. An increase by one the number of alerts, causes a decrease in the number of orders delivered on time with 271.7 orders.

References

[1] European Commission, (2014). *Politica UE în domeniul transporturilor*, Uniunea Europeana, Bruxelles, Retrieved from https://europa.eu/european-union/topics/transport_ro

[2] Customs Code of Romania, Law 86/2006.

[3] National Institute of Hydrology and Water Management (2017). *Hydrological warning,* Retrieved from http://www.inhga.ro/-/avertizare-hidrologica-nr-38-din-02-06-2016

[4] National Institute of Hydrology and Water Management (2017). *Warnings.* Retrieved from *http://www.inhga.ro/warnings*

[5] European Union, (2007). *Treaty on the Functioning of the European Union,* art. 174-178; Retrieved from http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2010:083:0047:0200:RO:PDF\

[6] World Economic Forum, (2016). *The Global Risks Report 2016,* Geneva, Retrieved from http://www3.weforum.org/docs/Media/TheGlobalRisksReport2016.pdf