APPLIED RESEARCH OF THE TRANSPORTATION LINKS ON
THE EXAMPLE OF LITHUANIA

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Abstract. Changes to foreign trade conditions also bring about changes to the main transport routes and
directions. Lithuanian transport companies must perfect their ability to adapt in a shifting environment, to
predict and readjust to the possible changes in the flow of goods, and expand the capability to build a new
foundation and appliance of transportation technologies. To support this, a questionnaire researching
transport must be made. This article contains an analysis of planning and conducting the research used to
determine the main directions of the flow of goods of Lithuanian transport companies, as well as criteria
concerning competitiveness among the companies.

Keywords: transport, research, transport flows, foreign trade.

1. Introduction

The role of transport sector in the economic
structure of the country determining its develop-
ment and the progress of the whole society is
very important. For example, in recent years
gross national product created by the Lithuanian
transport sector has been increasing and in 2009
came to 9 % of the total GNP, though this result
has been achieved by only 5 % of the whole
working population.

The centralization of foreign trade was dis-
solved 19 years ago allowing economic subjects to
trade freely with foreign partners. The geographic
structure of Lithuanian business links. Such reo-
riantation has had a positive impact on the devel-
opment of the economy and structural changes of
the whole country (Palsaitis 2003).

The progress of these days economy, the level
of development of different countries and the crea-
tive welfare of these countries depends of how
dep they join to the processes of globalization,
how easy they assimilate and applied to the pro-
gresyve technology, how could they organize the
international collaboration and which kind of or-
ganization model to used when organized the in-
terchange of raw and production (Adekola et al.
2008; Bernatonyte, Normantiene 2009; Ciegis et
al. 2008; Gronskas et al. 2008).

In these processes transport has one of the
main roles. Ashauer (1990a, 1990b) accents that
transport is a very important area of economy,
which influences the successfull economical de-
velopment of state because it takes part in inter-
change of raw and production and also is as mean
of promotion of international collaboration. With
this agree Button and Weindenfeld (1994a). They
said that creadibly funcionated transportation sys-
tem of Europe is the assumption of integration of
continent, the growth of economic and trade, the
competitive and equal conditions guarantee.

Development of foreign trade is an important
objective of the Lithuanian government. This is
being put into practice by liberalizing international
trade and demanding that export promotion pro-
grammes have an appropriate level of cooperation
since these relations are based not only on mutual
benefit, but also on the principles of good neigh-
borly values. Development of regional cooperation
is gaining more and more importance constituting
legal, financial and informative environment for
the movement of goods and capital.

Transport (its infrastructure, technological
processes and the means of transportation) is the
main mean, which provides a possibility for free
movement of goods, adding value to them, i.e. en-
suring the usefulness of time and place (Palsaitis et
al. 2004).

Many scientists of various countries have ana-
lysed the transportation process in different ways:
political, economical, social, technologycal and
ecological (Stock, Lambert 2004; Burgess 2001;
Chelsea 2002; Hendriks 2003; La Londe 1996;
Litman 1998; Mesguita 1998; Van Nes 2002; Pe-
tersen 2001; Runhaar 2002; Erera 2002; De Paepe
2002; Cascetta, Conigliaro, Di Gangi 1996; Bu-
rinskiene 2009; Klimo, Merkuryev 2008).

On the ground of analysis of opinion applied
in professional literature transport could be de-
ined as dynamical system adoptive to high operat-
ing technologies, which development governs not
only the demand of international market connec-
tions but also scientific and technical development
in different branches of economics.
The aim of the paper is to provide the process of the organization of the survey in the transport companies. And also to get information about the situation in the international transport market and how companies buying transport services from Lithuanian transportation companies evaluate them.

The methods of the research includes systematic analysis of scientific literature, logical summary of economic activities as well as quantitative research based on the surveys carried out in the field of transport.

The object of the research – the nomenclature of services provided by Lithuanian transport companies.

2. Identification of the potential main problems in gathering information

The main problem of the research was to gather initial information since this process requires a great deal of labour. Problems also evolve when collecting information and trying to define the goals of the reorganization and development of the transportation service system. While planning the research, questions may arise in connection with the methodology of gathering the information, determining the extent of the research and the preliminary correction of possible mistakes following the course of processing and modelling the data of the research (Palsaitis, Litvinenko 2005).

In order to lower the cost and complexity of the research, there is possibility of using statistical data from the appropriate departments. However, some information is inaccessible due to confidentiality and not all the data gathered in departments are available to the general public (for example statistical data from the Statistics department). Furthermore, report-statistic data are not sufficient when analysing the configuration of transport channels, grounding territorial distribution of transport terminals and logistic centres, the selection of the structure of the transport park, its size and the like.

3. Research organization

The problems indicated above can be solved by using primary transport research data. It can be obtained by making observations in fixed points of the transport infrastructure and surveying the staff of transportation companies (heads of the companies, transportation managers and forwarding agents), as well as making a selective survey among the drivers of cargo-carrying means of transportation in specific places of the transportation net.

It is the most appropriate to conduct transport research on those highways where traffic intensity amounts to 10,000 vehicles per 24 hours and above (Jarzemskis 2003). Whilst conducting the research, the main point to be taken into consideration is that even if the research is ideally organized there isn’t a possibility to stop all the cargo-carrying cars passing-by and survey their drivers.

It is also advisable to determine several characteristics increasing the general set of the transport flow by several or tens of times. (Palsaitis et al. 2004). For this reason, in order to obtain the necessary information, it is expedient that selective transport research should be made determining the extent of the research in advance and summing up reliability of data and possible mistakes.

During the research the emphasis was put on the determination of territorial distribution of routes of various types of cargo-carrying transport means (ex.: town with tilt semi-trailers, town with isothermal semi-trailers and so on).

At the beginning of the research the structure of the loads and other characteristics were accepted while moving the net of highways N-cargo-carrying means of transportation. Let us admit that p is a part of cargo-carrying vehicles (tows with tilt semi-trailers) and q is the rest part of cargo-carrying vehicles. Previously it was mentioned, that there is no real possibility to survey all the drivers of cargo-carrying vehicles and to determine precisely the values of p and q due to the extent of the general set N.

Let us assume that we surveyed n drivers and established that \( p_0 = \frac{m}{n} \) is a part of cars with A characteristic in the flow of transport. Since \( p_0 \) is a realization of a certain chance quantity, range of \( p \) reliability level can be determined only by using probability theory.

Considering that researchers, working in the field of territorial distribution of transport bonds, are most often satisfied with the results falling in 90-95% reliability, we can define \( p \) value (define intervals) with 0,9 reliability in the following way (Palsaitis, Litvinenko 2005, Lukinskis 2003):

\[
p_0 - 1.64 \sqrt{\frac{(N-n)p \cdot q}{(N-1)n}} \leq p \leq p_0 + 1.64 \sqrt{\frac{(N-n)p \cdot q}{(N-1)n}},
\]

Since the values of \( p \) and \( q = 1 - p \) are not exactly known, inserting maximum values in formula (no.1) will provide suitable conclusion.

\[
p_0 - 1.64 \sqrt{\frac{0.25(N-n)}{(N-1)n}} \leq p \leq p_0 + 1.64 \sqrt{\frac{0.25(N-n)}{(N-1)n}},
\]
If we define \( p \) value with 0.95 then we have accordingly:

\[
0.098 \sqrt{\frac{N-n}{(N-1)n}} \leq p \leq 0.098 + 0.082 \sqrt{\frac{N-n}{(N-1)n}}.
\]  

Let us assume that

\[
\varepsilon = 0.82 \sqrt{\frac{N-n}{(N-1)n}}.
\]

\( p \) deviation from \( p_0 \) is acceptable for us. Then with the probability of 0.9 we can define the size of selective research in the following way (Lukinskis 2003):

\[
n = \frac{N}{1-1.4872\varepsilon^2(N-1)}
\]  

(6)

By equation number 6 we can determine the number of the drivers to survey, wishing to obtain the value \( p \) with an error of calculation \( \varepsilon \) and reliability level in 90%.

In this case using the equation No.4 we can define that:

\[
\varepsilon = 0.98 \sqrt{\frac{N-n}{(N-1)n}},
\]  

(7)

\[
n = \frac{N}{1+1.0412\varepsilon^2(N-1)}.
\]

(8)

Using equation No 8 we can define the number of the drivers to survey, wishing to gain the value \( p \) with an error of calculation \( \varepsilon \) and reliability level in 95%.

In case the reliability level is chosen in advance, level \( \varepsilon \) decreases assuming the extent of the survey increases.

Long term transport flow research experience has shown that transport flows are constantly changing; therefore, it is necessary to repeat research, since onetime research can produce incorrect results. In this case (Palsaitis, Litvinenko 2005, Lukinskis 2003):

\[
n = \frac{t^2 \left( \frac{M}{n} \right) \sigma_k^2}{\sum_{i=1}^{n} \left( \frac{N_k e_{i} \mu_k}{\sqrt{n}} \right)} K,
\]

(10)

Where \( \varepsilon_r \) is a relative mistake of separate factors and

\[
\varepsilon_r = \frac{t \sigma}{\mu_k \sqrt{n}},
\]

(9)

Where:

\( t \) - stands for the Student criterion;

\( K \)-coefficient, estimating inaccuracies and deviations due to rounding up the data \( (k_i) \), unclear data \( (k_z) \) incomplete record \( (k_z) \), and inaccurate answers \( (k_a) \).

Scientific experience suggests not to limit only on certain characteristics of one factor but also to invoke a multiple analysis of the problem. Therefore, it is advisable that the volume of the selective transport research, according to all the factors, should be determined using formula No 10.

\[
\text{In order to avoid possible variations the answer to this question was provided in the form of multiple choice. The reply to this question consisted of two parts: the respondents had to mark appropriate providers of the services and to specify distribution in percentage.}
\]

Whilst conducting the research, we tried to identify the markets where Lithuanian transportation companies operate and the companies buying services from them.

Therefore, the questioneer included a question helping to identify the main buyers of the services provided by Lithuanian transportation companies: "Who are the main customers using the services you provide?"

The results of this survey show us, that Lithuanian freight forwarding companies – 36 \%, companies of Western Europe including EU countries – 45 \% and freight forwarding companies from Eastern Europe – 19 \% (Fig. 1).

In order to identify which criteria are followed to choose the delivery route for goods, the respondents had to answer the following question:

"What criteria are followed in order to choose the route?"
The criteria were estimated by importance and all criteria are given in the Table 1.

**Table 1. Criteria of evaluating of the choice of the rout**

<table>
<thead>
<tr>
<th>The criteria</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td>59.09</td>
</tr>
<tr>
<td>Tipografy</td>
<td>1.14</td>
</tr>
<tr>
<td>The road condition of different countries</td>
<td>2.27</td>
</tr>
<tr>
<td>Terms of delivery</td>
<td>10.23</td>
</tr>
<tr>
<td>Limitation of vehicle technical condition</td>
<td>64.77</td>
</tr>
<tr>
<td>Time when traffic of cargo carrying vehicles is limited</td>
<td>2.27</td>
</tr>
<tr>
<td>Main rating of km</td>
<td>4.55</td>
</tr>
<tr>
<td>Empty run of cargo carrying vehicle</td>
<td>1.14</td>
</tr>
</tbody>
</table>

The results of survey show us (Tables 2–9), that more than 59 % of respondents note the safety factor as very important when they planning the delivery route of goods and less important criteria they chose the limitation of vehicle technical conditions (67 %), more then 55 % of respondents noted empty run of cargo carrying vehicle as ignoring criteria, almost 66 % of respondents noted that the road conditions of different countries were not important criteria and totally animportant criteria for 76 % of respondents was tipografy.

**Table 2. Very important criteria**

<table>
<thead>
<tr>
<th>The criteria</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td>59.09</td>
</tr>
<tr>
<td>Tipografy</td>
<td>1.14</td>
</tr>
<tr>
<td>The road condition of different countries</td>
<td>2.27</td>
</tr>
<tr>
<td>Terms of delivery</td>
<td>18.18</td>
</tr>
<tr>
<td>Limitation of vehicle technical condition</td>
<td>4.55</td>
</tr>
<tr>
<td>Time when traffic of cargo carrying vehicles is limited</td>
<td>1.14</td>
</tr>
<tr>
<td>Main rating of km</td>
<td>5.68</td>
</tr>
<tr>
<td>Empty run of cargo carrying vehicle</td>
<td>7.95</td>
</tr>
</tbody>
</table>

This issue was more relevant surveying foreign companies, because their replies could help to
identify weak points in specific fields of transportation service of Lithuania as a transit country.

### Table 7. Criteria which are ignored by respondents

<table>
<thead>
<tr>
<th>The criteria</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td>3.41</td>
</tr>
<tr>
<td>Tipografy</td>
<td>4.55</td>
</tr>
<tr>
<td>The road condition of different countries</td>
<td>3.41</td>
</tr>
<tr>
<td>Terms of delivery</td>
<td>0.00</td>
</tr>
<tr>
<td>Limitation of vehicle technical condition</td>
<td>7.95</td>
</tr>
<tr>
<td>Time when traffic of cargo carrying vehicles are limited</td>
<td>64.77</td>
</tr>
<tr>
<td>Main raiting of km</td>
<td>2.27</td>
</tr>
<tr>
<td>Empty run of cargo carrying vehicle</td>
<td>13.64</td>
</tr>
</tbody>
</table>

### Table 8. Not important criteria

<table>
<thead>
<tr>
<th>The criteria</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td>0.00</td>
</tr>
<tr>
<td>Tipografy</td>
<td>6.82</td>
</tr>
<tr>
<td>The road condition of different countries</td>
<td>65.91</td>
</tr>
<tr>
<td>Terms of delivery</td>
<td>0.00</td>
</tr>
<tr>
<td>Limitation of vehicle technical condition</td>
<td>3.41</td>
</tr>
<tr>
<td>Time when traffic of cargo carrying vehicles is limited</td>
<td>13.64</td>
</tr>
<tr>
<td>Main raiting of km</td>
<td>4.55</td>
</tr>
<tr>
<td>Empty run of cargo carrying vehicle</td>
<td>5.68</td>
</tr>
</tbody>
</table>

### Table 9. Totally animportant criteria

<table>
<thead>
<tr>
<th>The criteria</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety factor</td>
<td>0.00</td>
</tr>
<tr>
<td>Tipografy</td>
<td>76.14</td>
</tr>
<tr>
<td>The road condition of different countries</td>
<td>1.14</td>
</tr>
<tr>
<td>Terms of delivery</td>
<td>0.00</td>
</tr>
<tr>
<td>Limitation of vehicle technical condition</td>
<td>3.41</td>
</tr>
<tr>
<td>Time when traffic of cargo carrying vehicles is limited</td>
<td>7.95</td>
</tr>
<tr>
<td>Main raiting of km</td>
<td>4.55</td>
</tr>
<tr>
<td>Empty run of cargo carrying vehicle</td>
<td>6.82</td>
</tr>
</tbody>
</table>

One of the other objectives of the research was to establish clearly the main directions of the flow of goods and transit distribution. Services provided by Lithuanian transportation companies are used not only by Lithuanian, but also by foreign companies (that is transportation companies attend to Lithuanian and foreign companies). Therefore, the question had been formulated in following ways:

a) "If transportation services provided by your company are used by companies of Western Europe, what are the predominant directions of the flows of loads?"

b) "If transportation services provided by your company are used by companies of Eastern Europe, what are the predominant directions of the flows of loads?"

c) "If transportation services provided by your company are used by Lithuanian companies, what are the predominant directions of the flows of loads?"

In order to try to avoid essential inaccuracies and possible misinterpretations in the answers, the respondents received several variants of possible responses.

The answer to this question consisted of three parts: respondents had to mark the main direction of the flow of loads, to specify in percentage and enumerate the countries.

For example the question which was given to respondents "If transportation services provided by your company are used by companies of Western Europe, what are the predominant directions of the flows of loads?" gives us such results (Fig. 2):

![Fig. 2. The main direction of the goods flows of Western European companies if providers are Lithuanian transportation companies](image)

And other results are when Lithuanian companies used Lithuanian transportation companies for their needs (Fig. 3).

Figure 4 shows the results of the survey when Lithuanian transportation companies are used by companies of Eastern Europe.

Another question of high importance was "What in your opinion induces foreign companies to choose the services provided by Lithuanian companies?".
The essence of this question was to identify competitive advantages of Lithuanian transportation companies (the quality of services, the price of the service and the like). This was to be specified by transportation companies themselves. Before giving an answer to this question, the respondents were asked to look critically at the activities their companies were engaged in and only after that to pick out what, in their opinion, would be the most attractive about their services to foreign partners. The results of this research will help to evaluate market sectors attended by the main Lithuanian and foreign transportation companies, routes, distribution to individual countries, a change in the tendencies of the flows of loads, and etc.

After completing the research and applying the formulas (1)–(10), it became possible to calculate the distribution of flows of individual types of cargo-carrying transportation means and the like.

4. Analysis of the research data and identification of the most frequent mistakes

Drawing on many years of experience of transportation research, it can be affirmed that, in order to conduct research, it is essential to be well prepared in reference to the quality of questionnaire and appropriate processing of the results.

At the beginning of the research it is necessary, first of all, to select respondents (according to criteria characteristic to an individual case), select the place for the research and to calculate the extent of the research for an individual place.

After the necessary data is gathered, it must be processed. However, the analysis of the research data and execution procedures show that in most cases certain difficulties arise, to be more precise — the same mistakes are common in almost every research, i.e. rounding the data up or down, unclear records, an incomplete record and inaccurate answers (Palšaitis, Litvinenko 2005).

Rounding up or down of the data. Tendencies to round the data up or down are noticed in responses to the following questions: “What is the volume of the load”, “Distance of transportation” and “Quantity of the loads carried”. These mistakes are hard to avoid since respondents are often not ready; therefore, the figures given are a rough estimate. A proportion of the mistakes made during data processing are avoided by virtue of comparative analysis; however, inaccurate answers are common in 5–10 % of the questionnaires.

Unclear records. Unclear records occur when the survey is carried out on the road, the respondent's writing is hardly legible and abbreviations are used. Such mistakes are common in 0.5–10 % of the questionnaires.

Incomplete record. This mistake is usually made when a questionnaire survey of freight shippers and consignees are organized by post or e-mail. Only 30–40 % of respondents fill in the questionnaire immediately after they receive it; therefore, it must be repeated again and again.
Inaccurate answers. Answers to the questions are subjective and are often inaccurate. The longer the period of the research is the more incorrect the answers are. The same applies to the distance of transport and defining territorial distribution of points where the goods are loaded and unloaded. Incorrect answers constitute 5–10% of all the volume of the research (Palsaitis 2005).

By virtue of research it was established that a good preparation for transport investigations and blow-by-blow determination of the volume of research diminishes the volume, duration and expense of the research to the minimum extent.

5. Conclusions

In this paper the analysis on a scientists’ view to international shipment of cargos showed that the process of cargos transportation can be defined as conditionally self-contained system of objects that has particular features and connections between them. Many scientists accented and the results of research prove that market globalisation and increasing volumes of international trade are constantly raising demands for international business transportation services.

The results of the research give us the opportunity to evaluate the status of Lithuania in Europe in geopolitical and economical way; it is possible to affirm that the best way should be polarizing Lithuania economics towards custodian between wide market of usage and raw materials in East and technologically highly developed production market in West, the importance of transport. When polarizing towards transit transportation and their further development, the increasement of transport streams can be useful to Lithuania, whereas through territory of Lithuania goes even two international transport corridors in the direction of North-South and West-East, in which the incessence of transit transport steams is forecasted in the near future.

The results of the research show us that the increasing of amount of transit road transport is one of the most important factors of competitiveness that has influence on general Lithuania’s economics. Lithuania, being small and open to economics is necessarily subordinated to successful economical relations with other countries of common market and third countries, it is necessary to ensure effective and physical infrastructuure as well as business environment, which would organize presumptions to mobility, communication and cooperation of people.

References


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