TRANSPORT SYSTEM VIRUS ANALYSIS – THE CASE STUDY OF PROBLEMS IDENTIFICATION AND ANALYSIS IN DISTRIBUTION SYSTEMS

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ABSTRACT

Appropriate identification and analysis of problems occurring in complex distribution systems is a very crucial stage in the process of improving these systems. Effective distribution systems nowadays are critical to the success for trade companies. On the basis of problem identification and analysis tools known from the subject literature (among others ASIS model, Ishikava (fishbone) diagrams, impact wheels, current reality tree, risk assessment mapping tools (FMEA), cause and effect diagrams, Suzuki (ABCD), SWOT), the Authors of this paper proposed their own conceptual process framework of problems occurring in organization of transport processes within distribution systems. The proposed tool is a specific hybrid of solutions known from the literature. This theoretical process framework has been developed and successfully used within the frames of a project aimed at improving the distribution system of one of the Polish big clothes distributor. Problem identification and analysis tool of organization of transport processes in distribution companies developed within this project has been called Transport System Virus Analysis (TSVA) for the reason of a specific character of the results' presentation. In this paper basic assumptions and methodology of the tool developed by the Authors have been included. Additionally, in the practical part the Authors present an example of TSVA model adoption for problem identification and analysis in the distribution system of one of the Polish companies.

Keywords: Transport system, co-modality, efficient planning, analyses, distribution systems

1. INTRODUCTION

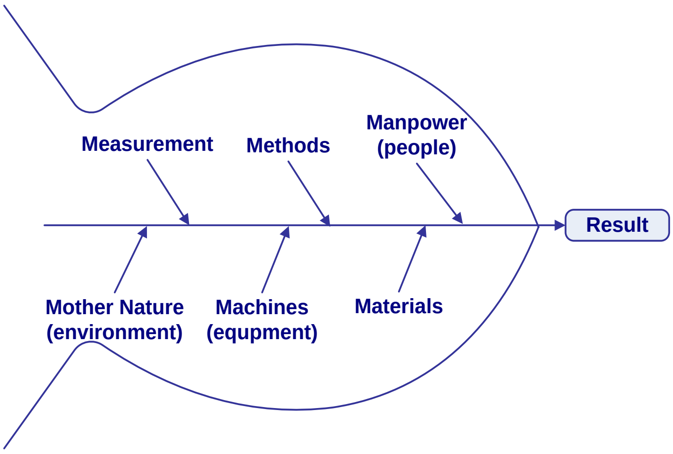
The goal of the firm is to maximize shareholder value [4]. Therefore, the management should focus on the value creation by exploiting the firm's value drivers. A value driver is any important factor that significantly affects the value of the company. There are two main sorts of value drivers: financial and non-financial which are also called managerial value drivers. Financial value drivers include actions such as capital structure changes, mergers and acquisitions, public offering or dividend distribution. These financial activities are performed by top managers, and usually their impact on shareholder value can be evaluated ex-ante as well as ex-post. Managerial value drivers include actions like strategic changes, reducing time to market, increasing throughput, or improving logistics, operations and supply chain management. While most firms devote their main efforts to exploit financial value drivers, not enough attention is being paid to managerial value drivers, although they have a much greater potential for value creation [1].
An effective transport system, one of the major elements of competitive advantage of companies, may be seen as both financial and managerial value drivers. Efficiently working transport system should be the basis of the effective functioning of the company, as well as the supply chain. Unfortunately, not all companies working within the supply chain may consider their transport systems effective, therefore, they undertake permanent corrective activities. As a general rule, a process of streamlining transport system is complex and difficult. Heterogeneity and a variety of problems increase difficulties in identifying the key problems which determine the effectiveness of the whole system. This paper suggests **Transport System Virus Analysis – TSVA** as a methodology for identifying and analysing problems. The theoretical process framework is a unique hybrid of widely-known solutions. It has been elaborated and successfully implemented in order to improve the transport system of one of the biggest market chain operator in Poland. Eventually, it has led to the improvement of financial state of the company through better use of managerial value drivers.

2. THEORETICAL BACKGROUND

The first step to be taken in any operation aimed at improvement is to understand a business process which is to be improved. One of the tools used to understand a business process is a process mapping, which serves several purposes. Firstly, it allows good understanding of the elements of a process – actions, results and participants. Secondly, it helps to define a process range and separate it from adjoining processes. Thirdly, it offers a point of reference against which a range of improvements is measured [2]. Apart from the process mapping, companies must apply more formalized procedures in order to be certain that a problem has been diagnosed correctly. Root Cause Analysis is a procedure which first involves brainstorming, which is meant to identify any potential causes of problems, and then collecting data and analysing them in an organized manner, gradually narrowing down the area of interest to a few root causes. Causal maps are one of the tools for the root cause analysis. In the operations management literature, causal maps are known under many names, including Ishikawa (fishbone) diagrams, impact wheels, issues trees, strategy maps, risk assessment mapping tools (FMEA) and, cause and effect diagrams. Operations management research often use causal maps as a key tool for building and communicating theory, particularly in support of empirical research. The only widely accepted approach for capturing cognitive data for a causal map is informal brainstorming, formal brainstorming, and structured interviews [3].

2.1 Tools for root cause analysis

The Ishikawa diagram, also known as the fishbone diagram and root cause analysis, is a simple causal map developed by dr. Kaoru Ishikawa, who first used the technique in the 1960s (Enarsson 1998, Kelley 2000). The basic concept of the Ishikawa diagram is that the basic problem of interest is entered at the right of the diagram, at the "head" of the main "backbone." The possible causes of the problem are drawn as bones off the main backbone (see Picture 1).



Picture 1. The Ishikawa diagram

Source: Own material

The categories often used as a starting point include materials, machines (equipment), manpower (people), methods, Mother Nature (environment), and measurement (the 6 Ms). Other causes can be selected as needed. Brainstorming is typically done to add possible causes to the main "bones" and more specific causes to the "sub-bones." This subdivision into increasing specificity continues as long as the problem areas can be further subdivided. The maximum practical depth of this tree is usually about four levels. Most quality management authors recommend using brainstorming methods to generate Ishikawa diagrams [20].
The impact wheel is a simple structured brainstorming approach designed to help managers fully explore the potential consequences of specific events and to identify consequences that they might otherwise fail to anticipate. Although simple, it is a powerful tool for investigating

future. The method is widely used by IBM, AT & T and Dayton - Hudson Corporation to identify new markets, products and services, as well as by the US Army to measure alternative tactics and strategies. In short, the group of experts analyse the influence of the introduced change on the other elements of the system, using the three criteria:

- The inferences – The “impacts” of the change;
- The probabilities – The likelihood (probability) for each impact;
- The implications – The cost and benefit of each impact.

The group then focuses on each impact and repeats the process.

Consulting firms often apply a causal mapping tool called an issue tree analysis. The approach helps break down an issue (a problem) into its major components (causes) in order to create the project workplan (Miller 2004). Causal mapping is also a key tool for risk assessment [14] and is known by several names such as fault tree analysis [16], event tree analysis [16] and **Failure Mode and Effects Analysis (FMEA)** [8]. These maps are used to provide a systematic method for identifying all types of potential failures, their potential causes, and their consequences. These methods are beneficial in the design of a product and a process, in improving understanding of the system, focusing risk mitigation efforts, and identifying root causes of failures. In Poland, Failure Modes and Effects Analysis (FMEA) which is a systematic way of looking at process and product failure modes is the most popular.

A cause and effect diagram is a causal mapping tool for quality improvement and plays a prominent role in quality management programs such as the Six Sigma program [20]. A cause and effect diagram is an extension of the Ishikawa diagram and is not constrained to the “fish” diagram (e.g. it does not require any pre-defined structure and does not use the “M” alliteration to identify potential causes) and uses ovals to represent variables. Many popular books (Pande and Holpp 2001) suggest asking the “five whys,” which ask “why” five times in order to uncover the root causes of a problem. Most quality management authors recommend using brainstorming methods to generate cause and effect diagrams [20].

ABCD methodology has been created to define the importance and range of particular reasons influencing phenomena. The other name is the **Suzuki method**, coming from the name of the originator. ABCD method is implemented according to the following stages:

- Definition of the roots of the problem
- Ordering roots
- Creating and filling in the tables of individual range selection
- Creating and filling in the collective table

- Ranking the roots according to the importance (range)

Table 1 presents the individual table, elaborated in the step 3 of the ABCD method.

Table 1. Individual selection table in the ABCD method

Criteria of evaluation – quality of the order realisation		Criteria rank (1 – most important , 10 – least important)									
Symbol	Name	1	2	3	4	5	6	7	8	9	10
A	Costs of supply										
B	Time of supply										
C	Safety of load										
D	...										

The fourth step is presented below. The extreme answers of individual tables are eliminated when filling in the collective table. The corrected sum of activities is calculated then. The measure is the sum of products – the number of significance and range of cause. The next step is to calculate the measure of range. Its volume is defined as a quotient of data in the column "corrected sum of significance" and "number of not selected answers". Finally, the lower measure of range, the more significant the criteria is.

Table 2. Example collective table in the ABCD method

Criteria of evaluation – quality of the order realisation		Criteria rank (1 – most important , 10 – least important)										Corrected sum of significance	Number of not selected answers	Measure of range	Range
Symbol	Name	1	2	3	4	5	6	7	8	9	10				
A	Costs of supply	2	1	2	1	0	1	0	0	0	0	15	5	3	2
B	Time of supply	2	4	0	0	0	0	0	0	1	0	9	5	1,8	1
C	Safety of load	2	0	1	1	1	0	1	0	1	0	20	5	4	3
D	...														

SWOT analysis is used to performed a strategic evaluation of the company and its processes. It enables reinforcing the strengths of the company, eliminating the weaknesses, making use of the opportunities and eliminating the threats. The name SWOT comes from four English words: Strengths, Weaknesses, Opportunities and Threats.
Opportunities – trends in the surroundings that are the incentive for development and reduce the Threats.
Additional questions are as followed:

- where are the field of the greatest chances for the company?
- what are the interesting trends in the surroundings of the company?

Opportunities may be stimulated through technology and market, in the micro - as well as macro scale.

Threats – all external factors being the barriers to the company, difficulties, additional costs of activities. The threats are destructive to the development of the organization and the success of the investment. At the same time, they do not enable to make the use of opportunities and strengths.

Additional questions are as followed:

- what are the obstacles for the company?
- what are the movements of the market competition?
- what are the technological changes that threaten the company’s position?
- changes of requirements for the company, product or service?

Strengths – attributes of the company positively distinguishing it in the environment. Strengths may come from the size of the organization, great share in the market, low unit costs, possessing new technology, quality of production.
Additional questions are as followed:

- what are the advantages of the company ?
- what is good about the company ?

Weaknesses – the consequences of insufficient qualifications and limited resources. They may concern the whole organization, as well as the part of it. Each organization has its weaknesses which, if too numerous, may destroy the company and bring losses instead of profits.

Additional questions are as followed:

- what can be improved ?
- what is done improperly ?
- what should be avoided ?
- whether competitive companies observe weaknesses of the company?
- whether competitive companies perform something better than the company?

2.2 Theory of Constraints in root cause analysis

Management problems are too numerous and new problems always occur one by one in organizations. Moreover, some apparently intractable problems exist that cannot be solved by past experiences. Theory of Constrains (TOC) elaborated by E. Goldratt has developed an effective technology for solving problems called the "Thinking Process". This process can be used as diagnosis in medical treatment, to list symptoms and identify "core problems", then to look for a new method of solving problems. Three questions then are discussed: "What to change?" "What to change to?" and "How to change?". The Thinking Process consists of formal analytical tools that are designed to help people answer these three questions. Such technology uses the "Current Reality Tree (CRT)" to diagnose causes or core problems, and the symptoms are called "Undesirable Effects". A common cause is deduced basing on the pattern of observed symptoms. A single symptom can have many causes, but a pattern of different symptoms may have just one plausible cause. Another useful technique of root cause analysis is "Evaporating Cloud" - a specific technique to identify the assumptions underlying the apparent conflict and break the deadlock [16]. The above techniques described by E. Goldratt [9] have both found their place in the Transport System Virus Analysis (TSVA) proposed by the authors.

The presented set of instruments (chapters 2.1 and 2.2) is very often used by project leaders to make wide and spontaneous discussion of experts more systematized and ordered. The authors are experienced at moderating meetings concerning identification and problem analysis in different areas of the company’s functioning, and according to their practice, each presented solution has its pros and cons. The System Virus Analysis presented below synergizes the selected elements of identification and problem analysis known from literature, combined in a logical sequence.

3. BRIEF METHODOLOGY OF TRANSPORT SYSTEM VIRUS ANALYSIS (TSVA)

TSVA is a practical method of identifying and analysing problems which occur in a transport system. The final result of realizing the subsequent stages of such analysis is creating the Transport System Problems Virus. The virus attacks healthy tissues of a transport system and causes their death or transforms them into hybrids, which do not fulfil their basic functions they are supposed to fulfil. Diseased tissues cause malfunctioning of a transport system, which leads into a decline in its effectiveness. Thus, clear identification of the problem virus becomes a key to its full elimination or at least restriction of its area of activity, which improves the effectiveness of the whole transport system. TSVA methodology assumes the realization of seven subsequent stages:

- Determining the objective of changes
- Appointing the team of experts
- Determining the performance measures
- Identifying problems
- Statistical analysis of identified problems
- Current state analysis (ASIS)
- Designing the transport system problem virus

All above mentioned stages will be shortly elaborated on below.

Determining the objective of changes

Problem analysis is usually the first stage in the realization of a transport system streamlining project, and that is why a clear definition of the objective of changes becomes an essential element of the TSVA application. The objective should be clear and comprehensible to all managers and employees in a company.

Appointing the team of experts

A team of experts should be appointed during direct workshops based upon brainstorming methods in order for them to identify and analyse problems in a transport system. Such team should include employees directly involved in a transport process, as well as employees from the auxiliary areas. The wider area of company's operation is covered, the more effective the problem identification process will be in a transport system. Covering all areas of the company's operation with team members' competencies guarantees the identification and analysis of problems appearing on the border of a transport area and other functional areas in a company. There is a possibility of further division of the team of experts into smaller groups in order facilitate the conduct of problem identification workshops based upon brainstorming methods.

Determine the performance measures

Objectives of a streamlining project should be measurable. It is thus essential to evaluate the advantages resulting from the implementation of improvements aimed at increasing the effectiveness of a transport system in a selected company. At this stage main performance measures of a transport system should be selected, and they will constitute a measurable effect of improvements. A large number of measures may pose certain problems. However, top managers are expected to manifest an ability to take right decisions and select maximum 10 main performance measures in a transport system, which will reflect a current state of affairs as well as future changes in the widest context possible (compare: example in chapter 3).

Identifying problems

Identifying problems in a transport system within the TSVA theoretical process framework assumes two stages:

- Workshops with experts where problems in a transport system are identified with the use of brainstorming methods. During such workshops commonly known tools, such as Ishikawa diagram, impact wheel tools, ABCD analysis, SWOT analysis, etc. can be used.

- Drawing and analysing maps of processes with the use of well known tools for creating such elements.

On the basis of the identified problems, the Team of Experts should determine the influence of each identified problem on the objective of the project of changes and its parameters described at the first two stages of the TSVA. It is suggested that relative dispersion rate should be applied in order to clearly determine the experts' agreement.

Statistical analysis of identified problems

A statistical analysis of identified problems is a stage where problems reported at the workshops by the Team of Experts are subject to grouping and a preliminarily analysis. What is analysed here is the influence of the defined problems on particular parameters of a success determined within the second stage of the TSVA. In such analyses various statistical tools are applied, such as histograms, bar charts, etc. Such prepared data are used to realise the next stage, which is a current state analysis and finding root causes.

Current state analysis (ASIS)

The main objective of this stage is to find root causes of a current state of affairs leading to low effectiveness of a transport system. According to TSVA methodology, the material gathered at the previous stages is analysed here. For the purpose of this task modified methodology of "Current Reality Tree" analysis has been applied. The basis for establishing relationships among identified problems within "Current Reality Tree" is, to a great extent, the 5 Whys method. When analysing the current reality tree downwards one starts with the most general problem and through why-questions comes to the main causes of such a state of affairs. An upwards analysis enables the following statement: if I solve the major problem, a problem which arises from it should solve itself too.

The transport system streamlining process must be based on facts, not opinions. Although members of the team may seem to have discovered the root cause of a problem, they must verify their views before they proceed to design a solution. A real data analysis based on tools including correlation diagrams, control sheets, Pareto analysis, etc. allows approval or rejection of the diagnosed root cause [2].

Designing the transport system problem virus

The last stage of the TSVA theoretical process framework is designing the Transport System Problem Virus. It consists of a central part called the nucleus and an external and internal coating. The nucleus reflects root causes identified and confirmed through the data analysis during the previous stage. In the internal coating there are major problems which cause a decrease in the effectiveness of a transport system of a company. The external coating is made up of protrusions which symbolise symptoms of problems which appear in a production system. Picture 3 in the chapter 3 shows an example of the Transport System Problems Virus.

4. THE EMPIRICAL VERIFICATION OF THE TSVA

The Author's theoretical process framework of identifying and analysing problems in a transport system has been implemented within a transport system streamlining project by one of the main Polish market chain operator. The transport system in the analysed company is in many aspects a typical representative of a company operating in a traditional way. The transport is realised in a standard way with the use of own means of transport or the external fleet. The main goal of the transport system functioning is the realisation of all transport needs, which means supplying goods to the markets. The expected effect of the TSVA tool is the identification of the key transport system problems, and then, their elimination.

Defining the objective

The main objective of the streamlining project in the analysed company was to design solutions whose implementation would improve the effectiveness of the transport system. It is required that the concept of improvement of the transport system's effectiveness is defined first. Thus, an effective transport system will be understood as the set consisting of the means of transport, transport infrastructure, people, as well as rules of its functioning. Those rules are responsible for moving people and goods. The rules of functioning are the rules of movement organisation [11, 12]. The main goal of the transport system functioning is the efficient organisation of transport processes through the effective use of means of transport, which will lead to the optimal and sustainable use of resources [10]. This approach is in line with the European Union policy promoting co-modality.

4.1 Appointing the team of experts

In order to identify and analyse problems in the transport system of the analysed company at direct workshops based upon brainstorming methods, the Project Team was appointed and then divided into three groups:

- Steering Committee – the Company's Board
- Core Team – consisting of twenty key employees of the company who are in charge of the main and auxiliary processes realised within the distribution area and

incorporating among others: Transport Manager, Service Manager, Sales Director, Purchasing Department Manager, etc.

- Support Team – consisting of eight employees in charge of the auxiliary processes and comprising among others: Chief Accountant, Human Resources Manager, Head of Stock Department, Head of Environmental Protection Management and Safety at Work Team, etc.

Each of the groups described above has an equal influence on the final result of the works. The division into smaller groups enables effective conduct of workshops based upon brainstorming methodology. The full approval of decisions made by the other groups lies with the Steering Committee. Such selection of employees which covers all areas of the company's operations can guarantee identification and analysis of problems in the transport system in a broad context of their effect on the overall performance of the company.

4.2 Determination of the performance measures

From among many performance measures used to evaluate the streamlining in the transport system of the analysed company nine were selected. They were not chosen at random, however. The main criterion is the verification of the co-modal approach in the organisation of the transport processes. Among others, there are financial measures, cost measures, safety at work measures, innovation measures, environmental measures and customer service measures. The group of selected measures comprises:

1. LF – Load factor – the percentage of the load of a trailer as regards the weight and volume

2. TCP – Transport cost of single pallet – the cost of transport of a single pallet as per 1 km/month

3. TCVD – Transport cost in value of delivery – share of costs of transport in the value of transported goods

4. IFGD - Indicator of Faulty Goods In Delivery - percentage of faulty items of goods against the overall volume of supplies within a given period of time

5. AFUT – Average Fuel Used per Truck – presents the average use of fuel per truck within a given period of time

6. WToT – Worktime of single trailer – level of the trailer maximum time of usage within a given period of time

7. RTSP – Reliability of Transport Service Provider – defines the number of properly realized orders by the external carrier to the total number of all orders of the carrier within a given period of time

8. IoI - Indicator of Introduction - describes effectiveness of a company within the implementation area. It is understood as the percentage of approved streamlining implementations per a time unit.

9. IHSW - Indicator of Health and Safety at work - shows the percentage of persons who suffered an accident on the premises of the company in the last quarter of the year

4.3 Identifying problems

A list o problem which occurs in the transport system was defined during workshops where brainstorming techniques were applied. Two analytical tools were used: the Ishikawa diagram and elements of the Impact Wheel. In the course of these workshops the Team of Experts identified 176 problems. For each problem a degree of gravity for the realisation of the project objective was determined (selected from the four options: very high - VH, high - Hi, medium - Me, low - Lo) according to the measures – compare chapter 3. On account of the right selection of employees for the Team of Experts the identified problems covered all the areas of the company's operations. The relative dispersion measure was applied in order to define the conformity of the experts.

4.4 Statistical analysis of identified problems

All the problems reported in the course of workshops were analysed in greater details. Table 3 (below) shows the identified problems along with the differences in their influence on the measures (LF, TCP, TCVD, IFGD, AFUT, WToT, RTSP, IoI, IHSW) and a category of gravity ascribed to them.

Table 3. Analysis of identified problems

	LF	TCP	TCVD	IFGD	AFUT	WToT	RTSP	IoI	IHSW	**TOTAL**
VH	19	18	8	9	1	17	2	2	3	**79**
Hi	45	23	54	14	1	45	2	9	4	**197**
Me	11	3	12	5	0	9	1	4	3	**48**
Lo	0	0	1	1	0	0	0	0	1	**3**
Suma	**75**	**44**	**75**	**29**	**2**	**71**	**5**	**15**	**11**	**327***

Source: Own materials

*The total number of problems presented in the table above does not correspond to the actual number of problems identified during the workshops where 176 problems were identified. The total number of problems in the table results from to the fact that the problems may affect more than one measure.

According to the above table important problems (60%) constitute the biggest group. The second largest group comprises problems classified as Very Important (24%). Other problems constitute only 16%. Thus, it is clear that classic Pareto principle was applied here

– approximately 20% of all the problems were regarded as very important. The estimation shows that solving these problems will allow realisation of 80% of the assumed effects.

4.5 Current state analysis (ASIS)

The process of documenting the current state of affairs in the analysed company starts with identification of a major problem, which is ineffective transport system. There are two main reasons for such a state of affairs:

1. Lack of goods on the shelves.
2. High logistics costs.

Lack of goods on the market shelves results from the following:

- Deliveries are not on time – poor technical state of means of transport is the main reason for that (failures or frequent controls by Main Office for Road Transport)
- Human resources management – within the current model of information exchange between technical department (maintenance of means of transport) and transport department (planning routes), it is impossible to identify which means of transport are available and which are at servicing at the moment. As a result, routes are planned for unavailable vehicles.

Considering the reasons for the lack of goods on the market shelves, it is clear that poor technical state of means of transport and lack of procedures for transport processes organisation are the main reasons. Poor state of fleet results mainly from improper policy of exchanging vehicles. The roots for such situation are as followed:

- Lack of assessment of transport system – company does not control realized processes in line with quality and quantity measures
- Lacks of information flow about the status of the means of transport – employees planning routes are not informed if a vehicle is available, when is the service envisaged and what is the stage of realization of the order.

The wrong policy "make or buy" is the main reason of the above described phenomena.

High logistics costs result from:

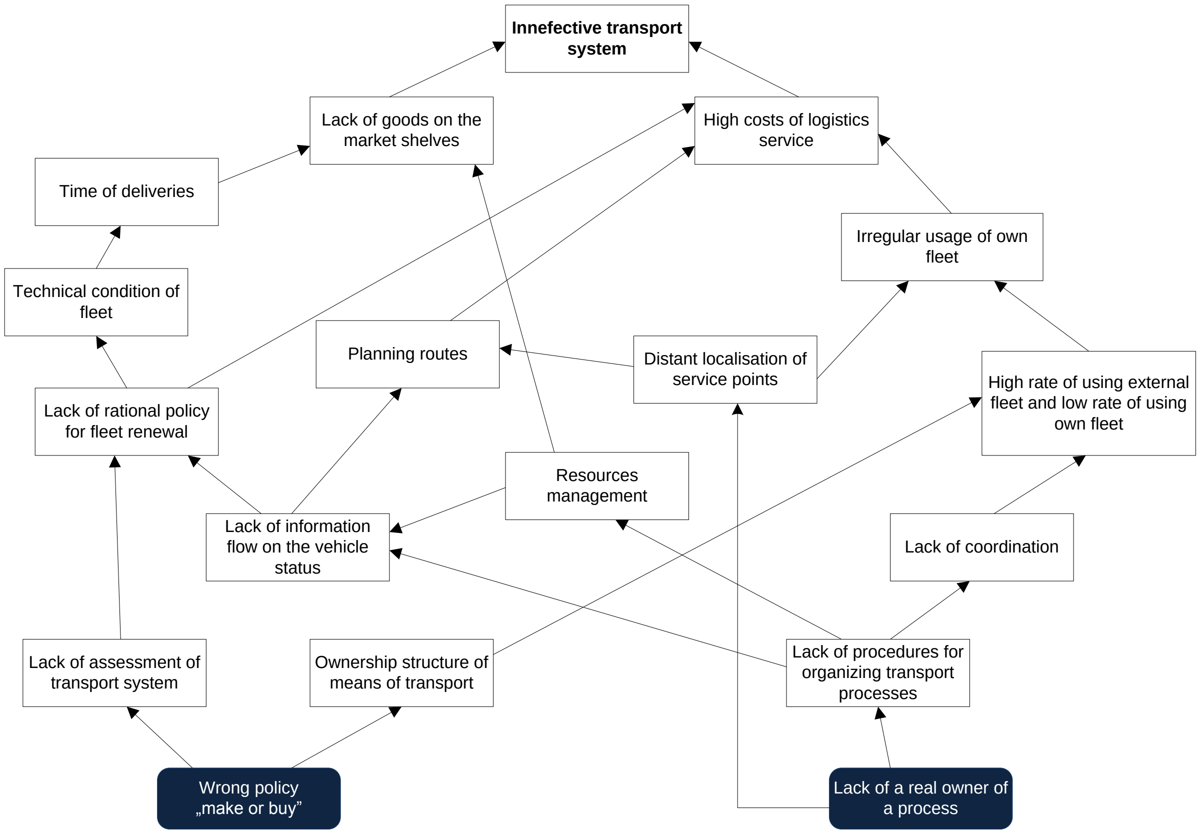
- Lack of rational policy of exchanging fleet
- Organisation of carriage processes – lack of innovative IT tools enabling the planning of carriages and exchanging information between people realizing transport processes

- Irregular usage of own means of transport – there are great differences in the mileage of own fleet.

The lack of information is again the reason for the lack of rational policy of exchanging fleet. There are no data on measures such as costs of own and external fleet, number of failures, reliability, etc. Those are the basis for decisions on exchanging vehicles. The problem of ineffective organisation of carriage processes results from the lack of IT tools supporting the process of planning routes linked with electronic map and financial system updating realized processes. Furthermore, it is impossible to precisely track working time of trailers and the current status of the trailer. The software does not include information about starting and ending time, as well as time of stops at delivery points. Additionally, employees responsible for planning transport processes are not in possession of information on trailers that are not used at the moment. Service points are distant which is the reason for additional costs.
Irregular usage of own means of transport results from the following reasons:

- Unfavourable localisation of service points.
- High rate of using external fleet and low rate of using own fleet – total costs of transport are higher.
- Lack of co-ordination – in general, undefined competences, responsibilities, lack of decisions.

Organisational and decisional chaos is caused directly by incorrect information flow, with the reasons described above. Another important reason for such a chaos to arise are fuzzy boarders of responsibility, which stem from ambiguously defined competencies and a scope of responsibility for each particular workplace. Lack of a real owner of an area/process is regarded to be its root cause. Picture 2 illustrates the analysed problems.



Picture 2: Current Reality tree for the company's transport system
Source: Own materials

4.6 Designing the Transport System Problems Virus (TSPV)

On the basis of the discussions resulting from the earlier stages, the Transport System Problem Virus of the analysed company was designed according to the methodology described in chapter 2 (see Picture 3).

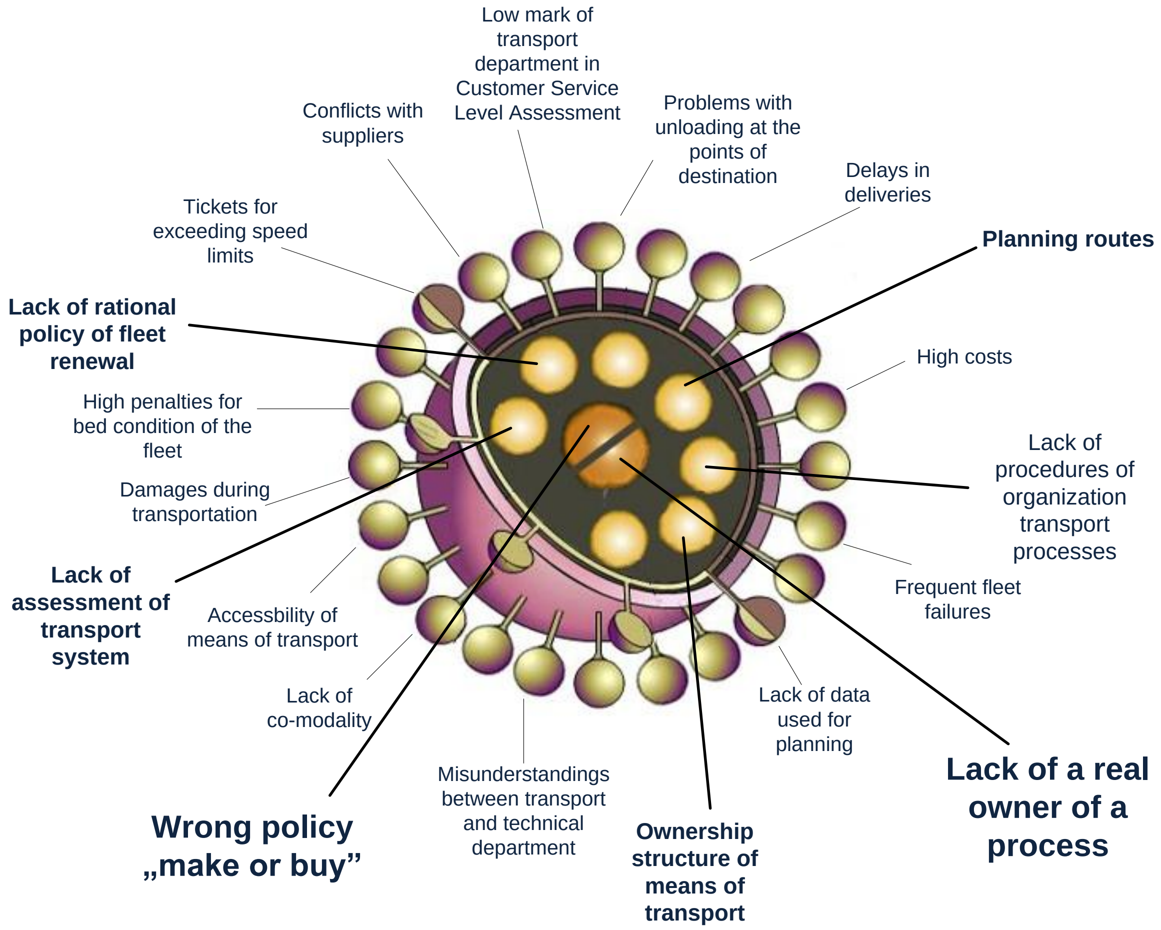


Figure 2. Transport System Problem Virus of the analysed company

Source: Own materials

The main goal of the company is selling goods with a profit. The transport system is designed to support this goal. Nevertheless, following the analysis it is clear, that the company encounter a wide range of problems linked with management process. The most important are flow of information issues, division of competences and the planning model, and organizing the transport processes. Another problem is the structure of the means of transport – the company uses own and rented fleet without applying basic analyses of the efficiency of the activities. All described problems influence high costs of the organization of logistics processes. Thus, it is clear that it is necessary to introduce changes in the company, starting from implementation of the transport processes organization model which precisely defines the scope of responsibility and the means of tasks' realization. Currently, the analyzed company does not learn from its mistakes – wrongdoing is notorious.

Basing on the analysis carried out, a wide range of actions have been taken up in order to destroy the core of the problem's virus. General features of activities and results are presented in the table below.

Table 4. General features of results and activities

Problem	Activities	Results
Wrong policy „make or buy"	• Model of transport processes management was created in the	• Initial calculations resulted in reducing costs by 13,5%.

	company • Policy for exchange, purchase and maintenance of fleet was created in order to increase reliability of the transport system and improve its technical state. • The company decided to cooperate with new suppliers of transport services and to use electronic data interchange with carriers.	• Company sold the fleet not meeting the defined requirements • Problem concerning the lack of fleet was eliminated • The rate of working time of vehicles increased by 8%.
Lack of the process' owner	• Model of transport processes management was created in order to assign competences • The existing system supporting logistics processes management was reengineered as regards preparing the data set for employees planning transport • Algorithms concerning transport processes planning enable additional requirements for points of delivery (e.g. no ramps) were developed. • Algorithms for transport processes planning as regards trade-offs with inventory management.	• Virtual database interchange between department eliminated the problem • Planning process Fasing on standard data was introduced. • Technical state of transport means was enhanced; availability of vehicles was increased • The maximum loading capacity was increased; •

Source: Own materials

5. CONCLUSIONS

A remedy for the company's current condition is returning to the old but still up-to-date good practice principles – an organizational order. Applying praxeology principles in the company's management will allow the company to raise the effectiveness of the realised processes, while simultaneously understanding effects of both successes and failures of particular activities.
Destroying the virus as the reason for ineffectiveness of the transport system, depends on destroying the reasons which are its innermost part, that are the root causes. They are as followed:

- Wrong policy „make or buy",

- Lack of a real owner of a process.

Transport system streamlining projects should be directed mainly towards these two root causes. It will enable the elimination of major problems in the company:

- Lack of procedures of transport processes organisation
- Definition of the proper ownership structure of transport means
- Ineffective organisation of carriages (planning routes)
- Lack of clear evaluation of the transport system
- Lack of a rational policy of replacing fleet

and, consequently, the symptoms of the problems will disappear too.

At a cognitive level of the conducted research the most important finding is an empirical confirmation of the view according to which well known methods of problem identification and analysis deriving from various branches and attitudes can be integrated. The theoretical process framework of transport system problem identification and analysis (TSVA) proposed by the authors is a compilation of the classic methods (Ishikava (fishbone) diagrams, impact wheels, current reality tree, etc.), which together with a different visualisation of results constitutes an interesting complementation of such methods. Originality of the proposed tool relies in an original selection of tools and methods known in literature and a sequence of their use. Effectiveness of the proposed theoretical process framework of transport system problem identification and analysis has been confirmed by its empirical verification.

At a utility level of the conducted research the main result which has been reached is, apart from successful implementation of the theoretical process framework in the environment of market economy, creating the methodology which allows support of managerial decisions within the transport system problem identification and analysis.

The authors of this paper consider it necessary to continue the works over improving the TSVA within the following areas:

1. improvement of conduct of workshops based on brainstorming methods with a view to better identifying key problems of a transport system in analysed companies,
2. improvement of statistical tools used for the analysis of identified problems,
3. determining the next stage of the TSVA – designing the methodology of selection and deciding on the sequence of implementation of appropriate solutions which eliminate the transport system virus in analysed companies.

The last area in particular poses a major challenge for the authors of this paper. The analysed company is currently carrying out implementation works aimed at improvement of the transport system, which are a consequence of the applied TSVA tool.

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