

Activity Based Costing in Decomposition of the Road Transport Task¹

Magdalena Osińska

University of Economy in Bydgoszcz, Poland

Wojciech Zalewski

University of Economy in Bydgoszcz, Poland

The objective of this publication is to translate the activities included in road transport task into the language of tasks and to ascribe appropriate costs and economic effectiveness indicators to them. Such a representation is new in literature and serves as the base for any further analysis of costs carried in an international road cargo transport company. The suggested indicators refer to both direct and indirect costs which are carried. They also allow to evaluate the work of people involved in the organization and realisation of transport tasks. Additionally, the suggested cumulative indicators allow for the evaluation of transport tasks from the perspective of operational management of the company. The usage of the IT systems proved to be extremely helpful in this respect as they generate all the required information on the spot.

Keywords: activity based costing, decomposition of a transport task, cost management, international trucking company.

1. INTRODUCTION

The analysis of the activity based costing is a well known tool of the management accounting, which is most often used in large industrial and trading corporations. The usage of the ABC analysis is relatively seldom met in transport or logistics services. The exceptions in this area include the following publications: Matula (2010); Somapa, Cools, Dullaert (2010) and Hovila (2010). Taking the dates of the publications into account, we can observe that the issue of using methodology of activity based costing in transport companies is a relatively new phenomenon and surely requires more precise analysis. It is particularly important because of two reasons. First of them is the second wave of economic crisis rolling across Europe at the moment. The second one is connected with issues referring to sustainable economic development carried out by the European Union which aim at limiting the share of road transport in economy. Both of these facts make the companies watch their

cost analysis carefully and make them define their strategic aim understood as not increasing or even decreasing their costs. The traditional accounting of prime costs run in trucking companies (cf. Bentkowska-Senator, Kordel, Waśkiewicz, 2009) may not be enough, as individual costs must be carried, while repetitive actions can be optimized, which in turn will result in costs optimization. The construction of full account of costs in most cases, also for transport, can be represented by the following stages: identifying key activities, determining costs incurred by separated activities, appointing measures of activities and settlement of indirect costs.

The objective of the analysis carried out in this text is to translate transport task activities into the language of costs of activities and ascribing them appropriate indicators of economic effectiveness. Such a representation will serve as the base for further analysis of costs incurred by a transport company. The range of transport tasks discussed in this publication encompasses international road transport of cargo, performed both inside the European Union and outside it.

¹ Financial support of University of Economy in Bydgoszcz is gratefully acknowledged

2. TASKS PERFORMER BY AN INTERNATIONAL TRUCKING COMPANY.

The activity of transport companies which carry cargo by road inside and outside the European Union is often divided into so called inter-community activities and those which are described as international ones from the perspective of tax issues (cf. Łacny, 2009). On the other hand each carriage between any two countries, even if they are both located inside the EU, may be described as an international one.

As understood by this article, the transport tasks in the international transport of cargo means an analytical event connected with moving a vehicle in time (t) with crossing the country frontier, which involves carriage of cargo between two or more scheduled points, which results in costs or/and income for the company.

If we assume that transport tasks are the only source that generates income for the transport company, all costs described by the ABC method can be assigned to these tasks. Due to repetitiveness of the performed tasks, it is possible to decompose a task into separate tasks which provide desirable effect by means of generating income. The evaluation of the effectiveness of these tasks can be or even should be done according to dates of the cycle, i.e. in real time, not according to a calendar (usually in monthly cycles). The suggested attitude results mostly from the fact that tasks in international road transport of cargo cannot be planned in such a way that their beginning and finish fit into a calendar month. Hence the usage of the ABC method which will differ from the accounting method, as these records are usually done chronologically, as they appear.

Any transport task is usually performed with common sense and optimization kept in mind, also as far as the time of performance is concerned. The time is determined by appropriate regulations such as Regulation (EC) No 561/2006 of the European Parliament and of the Council of 15 March 2006 as well as by AETR Convention of 01 July 1970, but on the other hand it is determined by economic effectiveness. It is closely related with the characteristics of the international transport. Each activity can be formally completed only when all tasks included in this activity are completed, but also for analytical reasons the activity can be disrupted or closed at any given moment by the employee re-

sponsible for the carriage – the freight forwarder. Such solutions can be applied while performing a transport task described as road tramping (Łacny, Zalewski, 2008) or in a situation when a vehicle performing the tasks does not return for a long time to a home transport base.

3. ACTIVITIES AND COSTS OF ACTIVITIES IN A TRANSPORT TASK.

In this paragraph we suggest a division of a transport task (later referred to as ZT) performed in a road transport of cargo into repetitive tasks, which were ascribed particular costs. Due to the fact that international hauliers in Poland usually belong to the group of medium and small enterprises, it is worth quoting the definition of Hicks (Hicks, 1999) who says that in a middle-size company a task is understood as groups of lined activities which allow to satisfy demand for a certain kind of work in a company. In a middle-size and small companies the tasks are performed by relatively few employees, and so while analysing one should focus on key activities (cf. Leszczyński, 2009).

Due to the above mentioned reasons, decomposing of a transport task into activities has been simplified in a sense that it refers to one task performed in a given period of time by one vehicle. The main carrier of the activity costs in this case is the cargo that needs to be transported by a vehicle, as a part of the service provided. The company resources include: vehicles, employees (drivers, freight forwarders, accountants, the board) and digital maps, transport exchange and any other tools which enhance the company's performance. They are the source of direct and indirect costs in reference to activities. Detailed information has been presented in Figure 1.

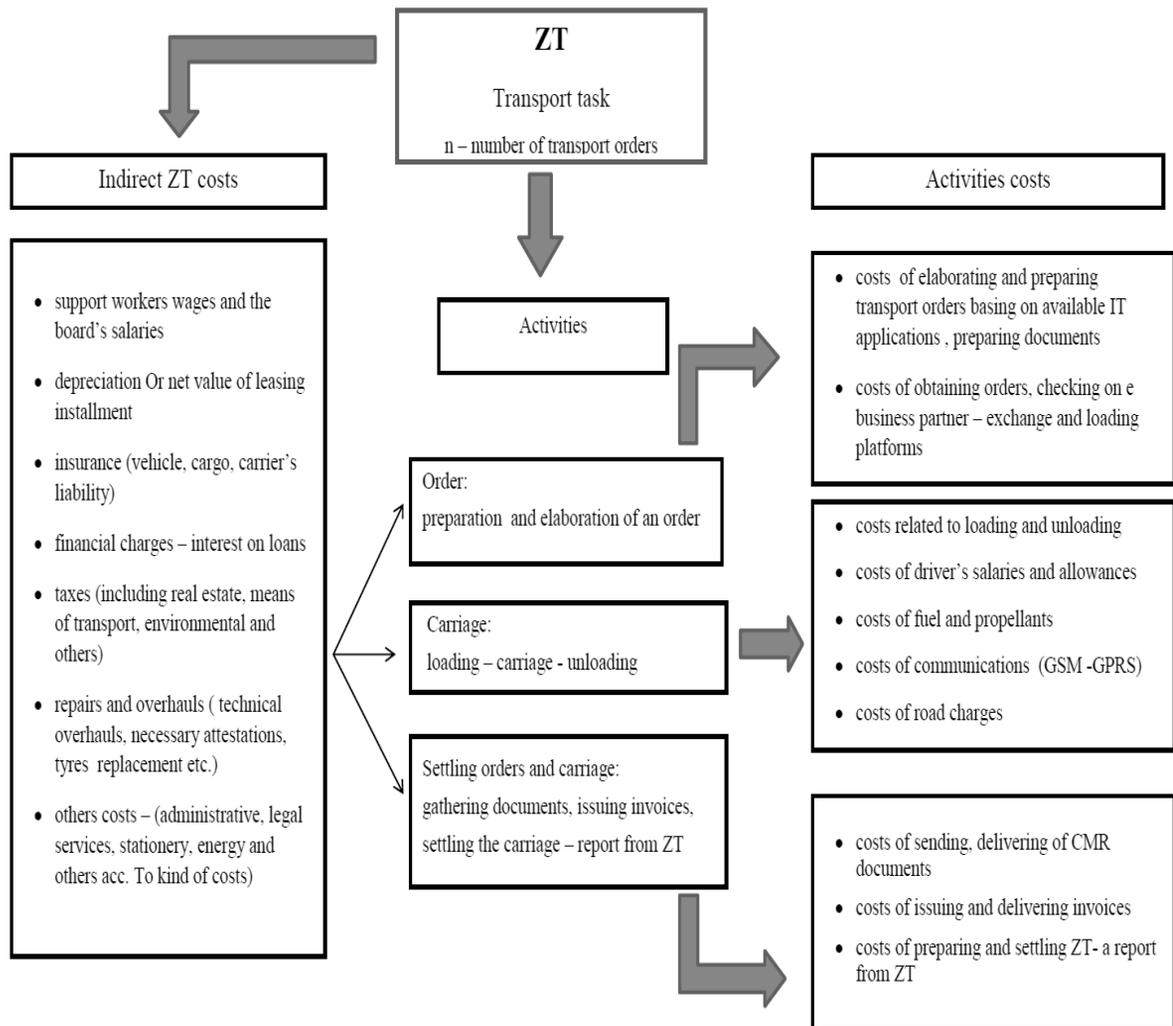


Figure 1. Decomposing ZT into tasks and relevant costs. Source: Authors' own study

While analyzing the scheme which describes a transport task and all activities included in it, it is possible to point to the costs which accompany particular activities and costs which refer to the whole transport task. When ABC method is applied, in a transport company which performs international carriages only, all costs, also the indirect ones, should be ascribed to transport task performed in a unit of time. It results from the characteristics of the performed business as transport services are the only carriers of income. The division of indirect costs can be done in proportion to days when a transport task was performed or in reference to the number of covered kilometres. In this respect it is important to include also the number of kilometres covered by a vehicle without any cargo onboard.

3.1. THE ACTIVITIES IN A TRANSPORT TASK AND ACCOMPANYING INDIRECT COSTS.

The realisation of tasks in ZT is a repetitive activity, which usually requires the need to perform similar scenarios which differ only as far as means of transport used for carriage, destination, kind of cargo and number of covered kilometres are concerned. In these areas some differences may appear both for specifying the vehicle route and for documentation indispensable for the carriage.

The main objectives of costing include: eliminating or minimizing costs of so called low or zero added value, featuring activities with high added value, searching for sources of emerging problems and their correction, eliminating errors while calculating costs (cf. Kaplan, Anderson, 2011).

The first activity in ZT is to elaborate and prepare orders which in modern transport companies should be based on initial calculation of offered freight for a service, including IT tools such as digital maps which allow to properly calculate the number of kilometres for a give transport order. Such a map allows to determine the distance between the first and the last loading point, as well as expected time of carriage and road charges which will have to be born. In modern solutions it is possible to schedule deliveries (unloading) depending on time windows when unloading is possible. It is oftentimes an important element of calculations which makes use of optimization methods included in IT systems. An important element of such planning is also determining the places for refuelling, which explicitly determines direct costs of a transport task. An indispensable element of such activating is also preparation of appropriate documents which are necessary to perform a task. It must be mentioned that one transport task may include a number of orders and as a result we must take into consideration the total time needed to complete all activities which are included in a task. The cost in this situation would be gross remuneration of an employee (a freight forwarder) preparing the realisation of orders in terms of working hours during an order (orders).

The main activity of a transport company is a carriage which should be realised on the basis of a planned route which could be altered by the driver only in case of emergencies, such as accidents or limited access. In transport companies which appreciate the value of navigation and telemetric systems, such pre-defined routes are transferred directly to the drivers' terminals in order to avoid situations when a driver makes decisions regarding the route himself. The activity also includes loading, unloading, fastening and securing cargo etc.

Referring to transport task costs it must be said that apart from costs connected with loading and unloading which depend on time, we also have the direct costs of transport which have been mentioned in figure 1. In terms of one vehicle-kilometre these are the highest costs which accompany the transport task (fuel, driver's remuneration, road charges and others). Due to the fact that these costs, in percent, are responsible for the biggest part of a transport task, it is essential that they are carefully planned in advance. Another important element of transport operation costs may

be the time lost due to road congestion. More and more often transport tasks are delayed because of congested roads, which generates additional costs for the whole transport operation. It is an extremely important element of performing any transport task as because of congestion the delivery time may be prolonged (e.g. in *just in time* method) not only due to additional amount of hours of stoppage, but also as a result of necessary rest for the driver.

Activities connected with settling orders and carriages are also very important as they determine the speedy payments for any transport task. Usually it depends on how quickly documents arrive from the driver especially the CMR, but also on how efficient the employees issuing invoices are. In this respect it is also possible that employees preparing the order and those settling it collaborate. It must be kept in mind that in small-size enterprises the same people may deal with these matters. An important aspect of realising a transport task is also its multi-criteria profitability analysis. Significant criteria include destination, means of transport and also the amount and price of orders being realised. A report which might be created in this respect, should include all the necessary data which allow to analyse a single transport task. As a result it will enable generating specification of tasks performed within a unit of time. The cost of this activity would be gross remuneration of employees participating in the process of settling a carriage.

3.2.INDIRECT COSTS OF A TRANSPORT TASK

Each transport task should be studied and complementary settled, as only this kind of attitude will allow to make full usage of the ABC method in reference to individual tasks. It will also enable the assignment of all prime costs to individual tasks.

If we therefore refer to previous statements we can assume that in case of realising transport tasks, the remaining prime costs can be referred to the number of days of effectively realised tasks or to the number of covered kilometres, assuming that transport effectiveness depends directly on the number of kilometres resulting from transport orders and on current freight rates.

In the discussed range also the indirect method can be applied which bases on ascribing indirect

costs to individual transport tasks. Direct costs are counted per number of days needed to realise a transport task or per number of kilometres covered by a vehicle while performing a transport task in a given time.

4. THE EVALUATION OF THE EFFECTIVENESS OF ACTIVITIES.

To evaluate costs and also the effectiveness of a transport task, it is important to evaluate the effectiveness of individual activities which constitute the result of the whole transport task.

The basic parameter in this respect is the level of margin achieved in a transport task, shown as absolute figures or in percentage in respect to achieved income.

In many cases not only transport tasks are analysed but also vehicles which perform them which allows to analyse the return on investment in vehicles, if they are not leased.

It must be pointed out that complementary evaluation of the effectiveness of activities, and hence of a transport task, is really difficult as it includes dynamically created elements. Especially direct costs, which change with transport tasks for various destinations as well as due to fluctuations of individual components of activities. In case of using IT solutions the process may be automated to some extent, which will significantly speed up the settlement.

4.1. THE EVALUATION OF COSTS DIRECTLY RELATED TO ACTIVITIES.

If we refer to costs directly related to individual activities in a transport task, we may evaluate the actual costs or determine indicators describing the effectiveness of activities. The measure given below allows to allocate costs of each activity to key costs. As it has been mentioned in point 2, the main carrier of costs is the cargo from the moment it has been obtained and prepared, through the carriage until it has been unloaded. The relevant objects are: ordering party, contracting party transport service, information channel which allows the optimization of realising a few orders in ZT.

As far as elaborating and preparation of orders are concerned, one may refer to costs of IT appli-

cations in use. If a company does not possess such applications, one refers only to costs of an employee who prepares, plans and supervises an activity. The cost of maintaining the quality of realised orders may be important at this point as this cost translates into results. If a person preparing a transport order will not see to all documents of both drivers and those accompanying cargo, it may cause a delay or even a stoppage in the process of realising an order. As a result it may delay the whole supply chain and may result in e.g. contractual penalties calculated by the ordering party. As it has been mentioned, in a traditional contract, the costs of preparing orders mean calculating costs of an employee in reference to the number of orders which were realised in a transport task. Such a calculation can be done on the basis of the following formula:

$$K_{JZ} = \frac{W_{PR}}{L_{ZL}}$$

where: K_{JZ} - unit cost of elaborating and preparing an order, W_{PR} - the value of Gross remuneration of an employee in time t, L_{ZL} - the number of orders prepared and elaborated in time t.

With further analysis one may calculate the cost of preparing orders in a transport task in terms of time spent on this activity within the whole transport task². It also refers to costs of settling a task, preparing documents and issuing invoices. In the last aspect the additional external element which adds up to settling orders are costs of sending CMRs, when after completing the order continues his activities, and costs of sending invoices to business partners. Having the above in mind, the costs of settling orders and tasks will be calculated similarly to calculating costs of elaborating and preparing an order. The key activity, and the most costly one in ZT is the carriage itself. The division of activity costs into loading, unloading and transport can be done assuming that the costs of loading and unloading will include the driver's remuneration, per time unit. Simplifying we may assume that the cost of the driver's remuneration apportioned into number of days when the transport task was realised. It is therefore important in a company to reasonably use the time complying with regulations. In case very specific carriages are realised e.g. expensive of timely cargoes, the companies oftentimes provide two drivers for a task.

² In this respect a modified version of ABC method is used, i.e. TD-ABC.

Other costs related to realising the transport result from costs born while performing a task such as fuel, road charges, parking charges, driver's allowance, phone charges and so on. These costs are directly related to realising a carriage.

The indicators which accompany the evaluation of the above described activities include:

- The value of freight from all orders, which were realised in transport tasks, in a given time unit. This quantity can define the company's ability to acquire most profitable orders and enable comparing incomes in a unit of time e.g. year-to-year. In international transport this value is often defined in EUR and/or PLN which results from conventional dependence, that freight is always given in EUR and most often calculated into PLN according to average National Bank of Poland exchange rate from the loading date or from the CMR date. The value of obtained freight may also be used as an instrument to evaluate freight forwarders' work in companies where transport orders are prepared and settled by a few people. Because of changing EUR rate as referred to PLN it is a good idea to refer to the value of income in comparable periods of time in EUR, i.e.

$$W_{ZL} = \sum_{i=1}^n W_{ZLj}$$

where: W_{ZL} - the value of all realised orders in transport activities of a given period of time, $i = \{1, \dots, n\}$ - the number of orders realised in transport activities, W_{ZLj} - the value of each individual order.

In a situation when more people deal with realising, and hence elaborating and preparing orders, comparing turnovers is one of the elements of competition and motivating employees.

- The effectiveness of realising transport orders - this indicator unequivocally allows to determine the efficient management of orders by a freight forwarder. It allows to compare the income indicator obtained from the orders as compared to the number of kilometres covered in this order, in reference to the income indicator from 1 km in the whole transport task. The income indicator from transport orders realised in a task takes the form of:

$$W_{ZLkm} = \frac{\sum_{i=1}^n W_{ZLj}}{\sum L_{km}}$$

where: W_{ZLkm} - the income indicator per kilometre resulting from transport orders in a transport task in PLN/km or EUR/km, W_{ZLj} - income from an individual order, L_{km} - the number of kilometres scheduled by a freight forwarder for the realisation of orders.

In practice this indicator defines the method of work of a person of people responsible for realising transport orders. Such a realisation should be prepared and planned in advance so each time a freight forwarder should calculate freight with the ordering party as referred to the number of kilometres which he planned as necessary for the realisation of the order. Such a calculation, often done with the usage of a digital map, allows to determine the relation between freight and 1 km. Therefore, if a transport task includes n-number of orders, we can obtain a planned value of income per kilometre from the obtained freights and planned number of kilometres.

The income indicator per 1 kilometre in ZT takes the following form:

$$W_{ZTkm} = \frac{\sum_{i=1}^n W_{ZLj}}{L_{kmZT}}$$

where: W_{ZTkm} - the income indicator per kilometre, resulting from transport task (in PLN/km or EUR/km), L_{kmZT} - the number of kilometres actually covered by a vehicle in a transport task.

At the moment of settling the whole transport task on the basis of a vehicle log book, GPS system or a tachograph, one can verify the actual number of kilometres covered. As it is usually known *ex post* there is no possibility to change the value of freight for individual orders. As it results from the analysis of IT systems used in international trucking companies, in most companies we obtain the difference of these values. Each properly scheduled task should be characterised by the following dependence:

$$W_{ZLkm} = W_{ZTkm}$$

Any deviation in plus or in minus is known and corrected ex post.

Comparing the two indicators allows to unequivocally evaluate the method of planning used for the transport task and its realisation. The next important indicator for the evaluation of a carriage could be the cost of used fuel in reference to the value of freight, which means percentage share of fuel in ob-

tained freight. The discussed indicator takes the form of:

$$W_{KPZT} = \frac{K_{PAL}}{W_{ZLZT}} \times 100$$

where: W_{KPZT} – the percentage indicator of the fuel cost in transport task income, K_{PAL} – the cost of fuel used to realise a transport task, W_{ZLZT} – the value of all orders realised in a transport task.

An exemplary table with data coming from the IT system showing the participation of fuel costs in a carriage is presented in Figure 2.

Figure 2. A printout from the TransSped version Tr441 IT system.

Nr	Nr rejestr.	Fracht	Koszt paliwa	udział % kosztu paliwa we frachcie	Liczba km
ZT/0278/2011	xxxxxxxx	31 277,26 PLN	15 408,00 PLN	49,3 %	8330
ZT/0260/2011	xxxxxxxx	20 029,29 PLN	7 484,47 PLN	37,4 %	5266
ZT/0254/2011	xxxxxxxx	18 113,04 PLN	7 734,00 PLN	42,7 %	4900

Source: Own study

The cost of fuel consumption is considered as compared to objective factors i.e. the level of actual fuel consumption in a transport task and average fuel consumption by a vehicle per 100 km and fuel prices. It has been shown in Figure 3. The data in the table only illustrate possible dependencies between the freight value in a transport task and the cost of used fuel. The research on a bigger group may allow to formulate further conclusions, including that on relation between the number of covered kilometres in a transport task and the freight as well as fuel cost. The additional aspect can be provided if we observe the percentage factor in reference to scheduled refuelling locations and preferred destinations in carriages. Interesting information is also provided by the reference of the fuel cost to the number of covered kilometres in the whole transport task.

- The third important indicator is the use of time in realising a carriage as well as load-

ing and unloading. What is meant here is the comparison of the given realisation time which results from previously quoted legal regulations in reference to actual time of carriage, and hence the whole transport task. Planning of the whole transport task is a very important and responsible activity, as apart from all direct costs such as fuel, highway charges, parking charges, communication etc. the cost is also that resulting from time which the driver needs to perform the carriage. In a very simple way it can be *ex ante* shown, with an assumed average speed of vehicle and exact size of time windows for loading and unloading, what the probable time needed to realise the carriage is, with maximum legally approved time periods for driving, breaks in driving and compulsory daily, weekly etc breaks. Lack of appropriate planning of tasks may hinder performing the task at the required time. Although motivating drivers with the number of covered kilometres is against the law,

but still many international trucking companies, basing on legal regulations, control and analyse daily number of kilometres covered by the driver. It is of great importance for vehicle mileage planning and realising the income rule, as international transport generates income basing on effective i.e. loaded kilometres of vehicle mileage. Due to growing competition and big supply of transport services, the opportunities for contracting freight with paid so called empty kilometres disappear. In this respect telematic systems become more and more important as they allow to track and trace the transport task *on-line* and especially to follow carriage, load-

ing and unloading. At the same time they compare the time left until the planned task completion in the context of scheduled unloading date and the duration of unloading. In the context of comparing the scheduled time and the realisation time it is possible to define the discrepancy between the two. It must be kept in mind that every discrepancy in scheduled delivery times may result in additional costs.

An example of real data from the IT system which allow the evaluation of a carriage have been presented in Figure 3.

Figure 3. A printout from the TransSped version Tr441 IT system.

Nr	Nr rejestr.	Km całkowite	Liczba dni	Fracht	Fracht na dzień	Km / dzień	Liczba dni dekl.
ZT/01600/2011	xxxxxxxx	1 509,0 km	2	4 668,00 PLN	2 334,00 PLN	754,5 km	2
ZT/01101/2011	xxxxxxxx	2 678,0 km	4	9 371,07 PLN	2 342,76 PLN	669,5 km	5
ZT/01015/2011	xxxxxxxx	2 555,0 km	4	8 410,00 PLN	2 102,50 PLN	638,7 km	4

Source: Own study

The indicators presented referring to activities in a transport task do not show the whole area being analysed, but only selectively present the opportunities for multi-criteria evaluation of tasks. Any further research in this respect will probably lead elaborating a coherent procedure, basing on indicators which will allow a comprehensive evaluation of tasks.

4.2. THE EVALUATION OF COSTS INDIRECTLY RELATED TO ACTIVITIES.

Costs which are indirectly related to activities are the most difficult part of cost analysis of transport activities included in transport task. As it has been mentioned before in order to use ABC method for this purpose it is necessary to have the access to the archives of analytical prime costs data. Basically there are two, in practice three, possibilities to formulate these costs for a transport task. Each of these forms will be partly a simplification, but if the data analysis refers to longer periods of time when transport tasks are performed, the statis-

tical error will decrease. Despite many advantages, the ABC method is not able to completely eliminate problems occurring while using certain keys for costs shares.

There is a new attitude towards registering transport tasks in e.g. IT systems which means registering analytical events such as transport tasks in the following way. A freight forwarder registers the initial date of a transport task and then, after the task has been completed, a real date and time of its completion. As it often happens that a vehicle is waiting for the next task to begin, which starts with the next loading so in order to avoid breaks in transport tasks and at the same time to enable ascribing correct indirect costs, one could record the date of starting the next task one day after the previous one has been completed. Such method would guarantee distribution of indirect costs into all days of realising a transport task. It would be possible to completely reduce errors in registering indirect costs and also to use some motivating methods for freight forwarders working with overlapping transport tasks and their optimization. What is

meant here is to create a situation when transport tasks overlap i.e. a vehicle which has just completed a transport task would be able to start the next one in the shortest time possible.

The first described way of qualifying indirect costs lies in calculating all indirect ZT costs presented in Figure 1 per one calendar day or per one working day. Calculation per calendar day seems more exact as transport tasks oftentimes can be and are performed during bank holidays. The second way lies in calculating these costs per 1 km of the company's vehicles mileage.

Probably the third way would be the closest to reality i.e. the division of indirect costs into these which will be referred to the number of days, and those which will be calculated per kilometre. Analysing initial costs in respect of their kind, one may divide the costs into these which are clearly ascribed to a vehicle, and those which cannot be ascribed to a vehicle. The first group includes: monthly value of depreciation deduction or the monthly leasing net instalment, the value of monthly Breakdown Cover and Liability insurance premium, interest on granted loan for a vehicle and/or trailer, semi-trailer, the value of tax on transport means, current repairs and overhauls, tyres replacement.

The second group includes: support workers' wages, salaries for the board and for the accountancy, stationery costs, any other indispensable costs of services, energy and other which can be classified. The costs which are defined according to their kind can be ascribed to particular tasks and then they can be calculated per calendar day, which in turn allows to refer them to the time of a transport task.

In reference to indirect costs which are not directly linked to a vehicle performing the carriage, the calculation will be done per all days of transport tasks in a given period of time. In modern companies this process can be usually performed in an IT system, which significantly simplifies it. It must be noticed that indirect costs which refer to individual vehicles can be included directly into a transport task in real time, but the costs which do not refer to means of transport should be registered *ex post* after getting the information about the number of realised transport tasks in a given period of time. Therefore it seems that the best suited method will be to use a mixed option, which will allow to leave a certain amount of costs as prime costs. It is the part of costs which is relatively less prone to changes. Hence, if we use this model of settling indirect costs for realised transport tasks, we can use the solution which has been presented in Figure 4

Figure 4. Part of records from TransSped version Tr441 IT system.

Koszt stały pojazdu: WGM 8A39			
Data		Miesiąc: 5	Data: 2011-05-01
Koszty			
Ubezpieczenie:	376.16	Naprawy	2680.00
Podatek od śr. transportu:	225.10	Przeglądy_Tachograf	260.00
Leasing:	6245.10	Inne	125.00
Odsetki od kredytu:	0.00	Inne	360.00
Rata kapitałowa:	0.00	Inne	200.00
Wynagrodzenie z narzut.:	2360.00		
Winiety:	0.00		
Razem (na miesiąc):	12831.36	Razem naczepa/przyczepa (na miesiąc):	2407.49
Razem (na dzień):	427.71	Razem naczepa/przyczepa (na dzień):	80.25

Source: Own study

Dedicated IT systems provide the possibility to register indirect costs referring to semi-trailer trucks and regular trucks, but also trailers or semi-trailers. Costs which have been registered in this way are calculated per one calendar day (see: Figure 4).

In order to have these costs settled per day precisely, they must be registered per month. It results from possible changes in these costs which could be caused by different factors. Obviously the lack of an IT system should not be an obstacle in such grasp of indirect costs referring to means of transport.

Indirect costs come from the accountancy department, or if repairs are taken into account from the garage, but also from invoices issued by companies providing services.

Having calculated the value of indirect cost per 1 day at the moment of registering the costs of a transport task every time we record this amount multiplied by the number of days when the task was performed. In case we use an IT system it is possible to automatically calculate these costs and to add them to the costs of a transport task.

Indirect costs which are not related to means of transport can be also summed up per month on monthly level and settled for each transport task on the day of its duration. The difference lies in the fact that if in the reference period n number of tasks is performed, then the value of these costs is apportioned to all days of realising tasks in total. The value of the cost calculated per month can be calculated with the help of the following formula:

$$K_{DP} = \frac{W_{KP}}{L_{DZ}}$$

where: K_{DP} – indirect costs calculated per 1 day (PLN), W_{KP} – the value of indirect costs in a month (PLN), L_{DZ} – the number of days of all transport tasks in a specified period of time.

If we adopt the same operating method and the same settlement of effectiveness by means of activity costs, it will have to lead to meticulous registering of all other events, which generate indirect costs. The record of all indirect costs can bring us closer to the real knowledge on how an international trucking company operates.

4.3. THE EVALUATION OF A TRANSPORT TASK IN A COMPANY.

In the previous paragraphs direct and indirect costs which appear in a transport task were dealt with. Also the indicators usually referring to these activities were covered. This paragraph will focus on the evaluation of the whole transport task in a company.

In order to perform the analysis of a single transport task however, apart from all costs both direct and indirect ones registration of orders is required along with the size of freight per order.

If we run our files in a discussed way it is possible to determine some important indicators, which describe the effectiveness of single transport tasks and hence take into account the number of tasks in time t , which enables examining the effectiveness of the whole company. It must be pointed out that this kind of attitude towards costs and incomes within transport tasks provides for excellent analytical possibilities which, if carried out, will allow to evaluate the effectiveness and to compare tasks related to different destinations, different drivers who perform them, by different means of transport, different number of kilometres in a transport task, providing different services, using traditional carriages or tramping versions, or even performing transport tasks for many days in different countries, if legal regulation allow that.

If we therefore sum up an exemplary transport task we can determine the following indicators:

- profitability of a transport task,
- cost per 1 km,
- freight (income per 1 km),
- margin per 1 km,
- margin in an absolute value.

Figure 5. The report from an exemplary transport task generated from TransSped version Tr441 IT system.

Raport ZADANIA - ZT/00282/2011					
Data wyjazdu:	2011-09-30 00:00	Data przyjazdu:	2011-10-17 00:00		
Ilość dni:	17				
Trasa:	YYYYYYYYYYYYYY				
Kierowcy:	XXXXX				
Samochody:	WGM XXXX, CB XXXX				
Długość trasy:	5289 km	Km ładowne:	4541 km	Km puste:	748 km
Zuz. pal.:	1743,69 l - 32,97 l/100 km	Zak. paliwa:	1743,69 l		
Zuz. pal. wg n:	1552,02 l - 29,34 l/100 km	(jazda/ogrzewanie/kompresor/agregat):	1552,02 l / 0,00 l / 0,00 l / 0,00 l		
Przepeł:	12,35 % - 191,67 l - 3,62 l/100 km				
Zak. Ad BLUE:	85,00 l				
Tony ogółem:	119,16 t				
	PLN /	EUR		PLN /	EUR
Fracht:	22214,26 /	5173,00	na 1 km:	4,20 /	0,98
Koszt:	20895,20 /	4775,93	na 1 km:	3,95 /	0,90
Marża:	1319,06 /	397,07	na 1 km:	0,25 /	0,08
Rent. %:	5,94 %				

Source: Own study

The report generated in Figure 5, which is shown here in shortened version, allows to obtain, apart from the above presented indicators, even bigger number of data referring to realising a carriage. It can for example be: the number of ZT days, the total number of kilometres covered, the number of kilometres covered by a loaded vehicle, the number of empty kilometres, the comparison of actual fuel consumption to consumption calculated on the basis of assumed norm, the number of cargo tonnes carried in a transport task etc.

The suggested evaluation is much wider than that which results from given prime costs recorded in accountancy. It must be noticed that the realisation of this exemplary transport task started in September and finished in October, which confirms previous observations that tasks should always be settled in real time not during reporting periods. Figure 6 presents the breakdown of indirect and direct costs for an exemplary transport task, in this case with random number 282/2011.

Figure 6. A printout from the TransSped version Tr441 IT system.

Koszt z dnia	Rodzaj kosztu	Ilość	Wartość netto wal.	Waluta	Wartość netto PLN	Wartość netto EUR
2011-10-13	Parking	0,00	7,00	EUR	30,21	7,00
2011-10-13	Paliwo	10,00	19,99	EUR	86,28	19,99
2011-10-03	Opracowanie_zleceń	0,00	120,00	PLN	120,00	27,05
2011-10-05	Autostrady	0,00	8,00	EUR	35,13	8,00
2011-10-07	Autostrady	0,00	10,80	EUR	47,28	10,80
2011-10-11	Autostrady	0,00	9,20	EUR	39,94	9,20
2011-10-11	Autostrady	0,00	47,30	EUR	205,33	47,30
2011-10-11	Autostrady	0,00	44,20	EUR	191,87	44,20
2011-10-11	Autostrady	0,00	9,20	EUR	39,94	9,20
2011-10-06	Autostrady	0,00	39,60	EUR	173,31	39,60
2011-10-14	Paliwo	925,00	3 892,40	PLN	3 892,40	898,23
2011-10-17	Paliwo	75,00	103,66	PLN	103,66	23,92
2011-10-12	Paliwo	300,00	424,20	EUR	1 830,42	424,20
2011-10-11	Paliwo	250,04	365,06	EUR	1 584,73	365,06
2011-10-03	Paliwo	80,40	339,25	PLN	339,25	78,29
2011-10-14	Paliwo	188,25	795,85	PLN	795,85	185,40
2011-10-13	Autostrady	0,00	356,51	EUR	1 538,73	356,51
2011-10-04	Parking	0,00	12,00	PLN	12,00	2,77
2011-10-14	Autostrady	0,00	12,17	PLN	12,17	2,80
2011-10-05	Koszty Pośrednie_ST	17,00	8 635,32	PLN	8 635,32	1 950,03
2011-10-15	Koszty Pośrednie	17,00	340,00	PLN	340,00	76,78
2011-10-06	Dieta	1,00	190,00	EUR	841,38	190,00
Podsumowanie					20 895,20	4 776,33

Source: own study.

The breakdown of transport task costs presented in Figure 6 contains both indirect and direct

costs. Direct costs were recorded according to the date of their appearance, which is also related to

the date of calculating PLN from EUR. It is in line with relevant regulations, which say that foreign currency costs should be calculated into Polish currency according to average National Bank of Poland exchange rate on the cost generation day. 'Indirect ZT costs' are the costs in reference to means of transport, shown in Figure 4 and calculated as for the first day of transport task. 'Indirect costs' are those which are not related to any particular vehicle, which refer to other costs in classification based on nature and were calculated for all transport tasks and for the number of days of their duration.

In order to obtain a summary of an absolute margin resulting from all transport tasks realised in given period of time, one should sum up individual margins obtained from tasks. The same may refer

to the answer about the value of cost per 1 km in a company.

In practice another scenario of settling direct costs is possible. It may be realised on the basis of calculating the value of direct costs per 1 km of vehicle mileage. In such case all direct costs of a transport task are registered, and indirect costs, including costs of repairing vehicles, are calculated dividing their number by the number of all kilometres covered by all used vehicles. This indicator can be further apportioned into: repairs indicator/km, administrative indicator/km etc. Such an attitude can show the costs in a more clear way. The application of an indicator understood in this way allows to add to each transport tasks the value of costs per 1 km or in absolute value dividing this indicator by the number of kilometres in a transport task.

Figure 7. A breakdown of transport tasks by means of transport.

Zadania Transportowe od 2011-08-03 do 2011-08-28 wdl. daty rozpoczęcia ZT;

Nr rej. pojazdu	Nr rej. naczepy	Km całkowite	Przychody PLN	Koszty bezpośr. PLN	Koszty napraw p. PLN	Koszty napraw n. PLN	Koszty Pośre_ZT. PLN	Koszty pośredn. PLN	Marża PLN	% marży	Koszt / km
XXXXXX	XXXXX	8 286	27 329,47	18 951,25	4 460,00	1 670,00	280,54	965,20	1 002,48	3,67	3,18
YYYY	YYYY	11 340	37 922,94	31 650,20	2 150,00	465,00	1 288,82	965,00	1 403,92	3,70	3,22
YYYY	YYYY	17 442	58 160,91	47 652,00	6 360,00	1 115,50	1 220,96	960,00	852,45	1,47	3,29
ZZZZ	ZZZZ	10 039	36 090,96	28 995,48	1 865,00	620,00	1 297,14	845,00	2 468,34	6,84	3,35
CCCC	CCCC	7 684	26 223,96	21 936,89	554,00	365,00	1 297,14	520,00	1 550,93	5,91	3,21
Podsumowan		54 791,00	185 728,24	149 185,82	15 389,00	4 235,50	5 384,60	4 255,20	7 278,12		3,25

Source: own study.

In Figure 7 there are data coming from an IT system TransSped version Tr441, where 5 means of transport participating in transport tasks from 3rd August until 28th August 2011 were evaluated for their effectiveness. Due to analytical character of this breakdown, the indirect costs were divided into vehicle repairs costs and costs trailer/semi-trailer repairs costs. This division is of purely informative nature and allows to reveal these, so important for the realisation of transport tasks values. It must be noticed that the summary of obtained margin on transport tasks, in reference to incomes from these tasks, allows to directly specify the level of profitability in a given period of time. Due to cognitive

nature of the presented cost analysis method, the data provided in the text are of selective nature and cannot be used as the source of comparison or further analyses.

As it has been mentioned before in this text such method of recording costs seems to be optimal from the point of view of company's characteristics. First of all it defines profitability of each transport task, and secondly enables a multi-aspect comparison of these tasks realisation.

5. CONCLUSION

The research show in this article dealt with presenting the idea of cost analysis for transport tasks in an international trucking company. Decomposing of a transport task has been performed into separate, repetitive activities, which were later ascribed appropriate direct costs. Two ways of settling indirect costs for tasks were suggested. Each task was ascribed appropriate indicator defining its effectiveness, from both individual and whole company's perspective. The methodology presented serves as the starting point and at the same time as recommendation of analysis carried in a road transport company. The examples which were parts of reports form an IT system designed and used in these companies illustrate practical possibilities of implementing the discussed methodology and using it for operating management in a company. It seems that in difficult times of economic crisis and conditionings resulting from organisational and legal changes, such analysis will allow companies to find savings or to eliminate negative outcomes of bad management.

6. LITERATURE

- [1] Bentkowska-Senator K., Kordel Z., Waškiewicz J., (2009). *Transport Samochodowy Ładunków*. ITS, Warszawa.
- [2] Hicks D.T., (1999). Yes, ABC Is For Small Business Too. *Journal of Accountancy*, No 2.
- [3] Hovila H., (2010). Activity-based Costing Case: DFDS LOGISTICS, Master Thesis https://publications.theseus.fi/bitstream/handle/10024/21709/Hovila_Henri.pdf?sequence=1
- [4] Kaplan R.S., Anderson S.R., (2011). *Rachunek kosztów działań sterowany czasem (TDABC)*. Wydawnictwo Naukowe PWN, Warszawa.
- [5] European Agreement concerning the Work of Crews of Vehicles Engaged in International Road Transport (AETR), done at Geneva on 1 July 1970 (Consolidated text, version 2006, document ECE/TRANS/SC.1/2006/2).
- [6] Łacny J., (2009). *Funkcjonowanie międzynarodowego transportu drogowego ładunków w gospodarce globalnej*. Wydawnictwo Naukowe Instytutu Technologii Eksploatacji – Państwowy Instytut Badawczy, Bydgoszcz-Radom.
- [7] Łacny J., Zalewski W. (2008). Tramping drogowy jako nowa forma usług w transporcie międzynarodowym i wewnątrzspółnotowym. V Konferencja Naukowo-Techniczna LOGITRANS nt. Logistyka, Systemy Transportowe, Bezpieczeństwo w Transporcie, Szczyrk 23-25 kwietnia 2008 r, *Czasopismo Logistyka* Nr2/2008, Wydawnictwo ILIM Po-
- znań oraz Politechnika Radomska im. Kazimierza Pułaskiego *Prace naukowe* nr 1/26/2008.
- [8] Leszczyński Z., (2009). *Rachunek kosztów działań w średnim przedsiębiorstwie*. Wydawnictwo Politechniki Łódzkiej, Łódź.
- [9] Matula M., (2010). *Rachunek kosztów działań jako metoda optymalizacji funkcjonowania przedsiębiorstwa* http://www.matulamarcin.pl/opracowania/rachunkowosc_zarzadacza/rachunek_kosztow_dzialan_jako_metoda_optymalizacji.pdf.
- [10] Regulation (EC) No 561/2006 of the European Parliament and of the Council of 15 March 2006, *Official Journal of the European Union* L 102 of 11 April 2006
- [11] Somapa S., Cools M., Dullaert W., (2010). Time Driven Activity-Based Costing in a Small Road Transport and Logistics Company. <http://preet.sesolution.com/iclt2010/Full%20Papers/Distribution,%20Transportation,%20and%20Traffic/0056-Sirirat.pdf>.

Magdalena Osińska
University of Economy in Bydgoszcz, Poland
magdalena.osinska@byd.pl