

Negation of Logistics Rules in Managing the Operation of Motorways in Poland

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Costs for tolling a motorway in Poland should take into account not only profits of owners and managers, but also difficulties and losses incurred by road users. Lack of smoothness of travel as well as high tolls do not have a positive impact on the country's economic development. The nervousness and stress of drivers and passengers trapped in cars standing in traffic jams in front of the gates on motorways - they indicate an important social problem. The costs of fuel burnt during forced stops, costs of harmful effects on the environment, pollution from car exhaust emissions while waiting on the highway in front of the gates – they all are a significant burden. Failure to ensure the conditions for a smooth ride causing the need to wait on the highway in front of the gates is an example of disregarding people, wastage and deliberate harm to the environment for disproportionate profits charges for using the highways.

Keywords: logistics, motorway, car, exhaust gases, environment.

1. INTRODUCTION

Infrastructure development is one of the most important decisive factors about the country's development. Appropriate road infrastructure should be the key element in the context of sustainable socio-economic development of the country. On the national scale, the construction of motorways and expressways has contributed to the territorial cohesion of Poland. Motorways and expressways on a national scale give a high added value, and on a local scale, they contribute to the rapid development of communes and poviats. Two-lane roads are characterized by a significantly lower risk of accidents as compared to single-lane ones. The construction of a motorway or expressway improves safety also on domestic parallel roads. [9]

For the time being there are three paid motorways in Poland, and some designated sections. Not every one of them is finished. Some of them are just short sections. None of the expressways in Poland is payable. Two tolling systems for passenger cars are in use on motorways in Poland - an open system and a closed system. An open system is a payment on gates set across the road. On tolled highways

where there are gates, usually there are traffic jams that can reach several kilometers in the height of the season.

2. THE ESSENCE OF LOGISTICS

The essence of logistics is to ensure the flow of material goods, people, and information based on the principles of 3R, 5R or 7R, which means, among others: the right product with the right quality and quantity needed, the right customer, in the right place, at the right time and at the right cost. Logistic processes are the integration of material and information streams, the efficiency of their flow, as well as the costs they entail. The concept of these processes also applies to customer service, its level, quality and effectiveness, as well as the satisfaction of the recipient [6, p18].

Taking into account the advantages of the logistic value creation system in the process of strategic analysis, shaping and achieving the company's goals should be reflected in the integration of elements of the overall enterprise strategy.

According to P. Blaik, logistic oriented and integrated management is an assignment, and integration of logistics into the system concept of

integrated enterprise management, where the cash flows constitute an integral component of logistics processes, Figure 1:



Fig. 1. Logistic pipeline cycle [6].

The management-oriented integration of all logistics processes takes on a basic meaning, as it determines and opens up new possibilities for solving problems and using potential effects in the sphere of strategic activity. The experience of highly developed countries confirms that logistics is beginning to play the key role in the process of reorienting management to strategic goals and determinants of effects and successes on the competitive market [1, p.230].

The logistic structure of business management complements logistic oriented normative management. The basic task here is to take into account and incorporate the principles of logistic thinking and acting in the process of formulating and institutionalizing the general "philosophy and culture" and the directional objectives and principles of operation (mission) of the enterprise [1].

Transport infrastructure as a component of logistics processes should be considered from the point of view of the efficiency of the flow of material goods in the sphere of transport, and minimization of the costs of this flow. Delivery of goods at the right time, to the right place, in accordance with the disposition of the disposer defines the flow efficiency. On the other hand, the minimization of transport costs depends mainly on the choice of the economic type of transport, specific means of transport, routes and transport time [6].

An example of reorientation of management to strategic goals may be the problem of traffic jams

being created in front of toll gateways on motorways.

When referring the logistics rules to motorway operation, it should be stated that customers using motorways in Poland have the right to demand the right service, i.e. an optimal, short-time journey, ensuring high quality of travel, the right place, the right time and the right costs.

Meanwhile, the conditions of traveling on Polish highways at weekends and on holidays deny the mentioned rules. On weekends and during holidays, when traffic is relatively high, traffic jams form on the highways before toll gates, which force drivers to wait up to three hours.

Contemporary understanding of logistic processes is the integration of physical streams and information, it is looking at economic processes through the prism of these streams, the efficiency of their flow and the costs they entail.

3. CALCULATION OF COSTS FOR HIGHWAY TRANSPORT IN POLAND

Motorways and expressways in Poland form a part of the Polish road network and are counted among the most important national roads serving international and interregional routes.

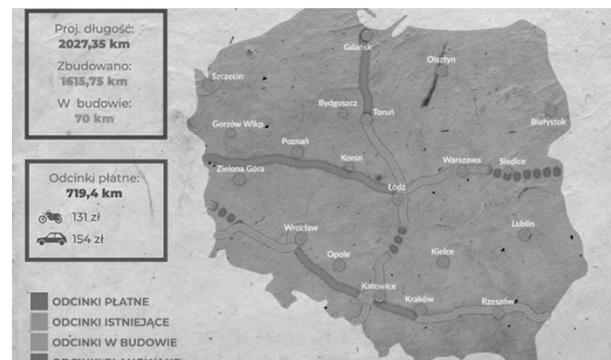


Fig. 2. Condition of motorways and expressways in Poland [8].

Source:

<http://www.expressilustrowany.pl/aktualnosci/a/platne-autostrady-w-polsce>

According to the plans from 2016, the length of expressways will ultimately cover about 7,650 km, which will consist of about 2,000 km of motorways and about 5,650 km of expressways.

The road parameters are defined in the Regulation of the Minister of Transport and Maritime Economy of March 2, 1999 on technical conditions to be met by public roads and their location [2]. The motorway differs from the expressway mainly in a way that the expressway:

can be single-road, has more nodes, sometimes has intersections, is located in the built-up area, it can be designed for a lower speed than the motorway, has narrower lanes, may have narrower emergency and shoulder belts.

Oil prices on global markets are constantly fluctuating. When oil prices on the global exchanges increased, fuel prices at Polish gas stations also increased systematically, but when oil prices dropped by several dozen (50 ÷ 60%), then fuel prices in Poland have remained at the same level since then.

The fuel price in Poland in almost 52 percent consists of taxes. The main factors shaping the level of fuel charges in the country are oil prices and finished products as well as the dollar exchange rate against the Polish zloty.

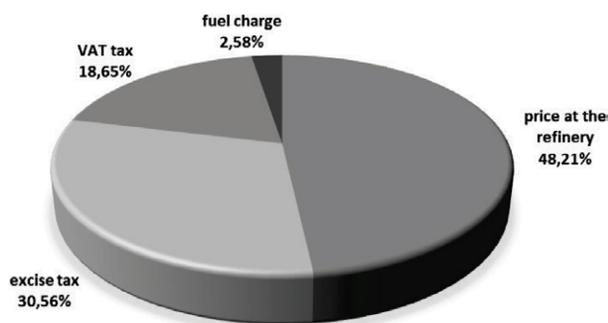


Fig. 3. Components of the price of gasoline 95.
Source: <https://www.e-petrol.pl/notowania/pomocne-informacje/podzial-skladnikow-cen-paliw>

Table 1. Retail prices of fuels in selected cities on 09/07/2018.

Average retail prices of fuels in voivodship cities PLN/liter				
city	PB 98	PB 95	ON	LPG
Szczecin	5.28 PLN	5.01 PLN	4.88 PLN	2.02 PLN
Gdańsk	5.24 PLN	4.98 PLN	4.81 PLN	1.85 PLN
Poznań	5.24 PLN	4.97 PLN	4.73 PLN	1.90 PLN
GorzówWlkp.	5.23 PLN	4.97 PLN	4.82 PLN	1.96 PLN
Wrocław	5.24 PLN	4.99 PLN	4.77 PLN	1.83 PLN
Opole	5.19 PLN	4.93 PLN	4.66 PLN	1.94 PLN
Katowice	5.19 PLN	4.93 PLN	4.63 PLN	1.76 PLN
Kraków	5.16 PLN	4.93 PLN	4.68 PLN	1.78 PLN
Rzeszów	5.14 PLN	4.93 PLN	4.76 PLN	1.73 PLN
Kielce	5.17 PLN	4.94 PLN	4.64 PLN	1.78 PLN
Łódź	5.28 PLN	4.97 PLN	4.74 PLN	1.81 PLN
Lublin	5.15 PLN	4.91 PLN	4.68 PLN	1.84 PLN
Warszawa	5.28 PLN	5.02 PLN	4.81 PLN	2.00 PLN
Białystok	5.15 PLN	4.90 PLN	4.71 PLN	1.77 PLN
Olsztyn	5.15 PLN	4.90 PLN	4.85 PLN	1.82 PLN
Bydgoszcz	5.21 PLN	4.93 PLN	4.71 PLN	1.89 PLN

Source: www.money.pl

Table 1 shows that the differences in average retail prices of fuels in various Polish cities reach: 2.25% (Pb 95), 2.65% (Pb 98), 5.4% (ON) and 14.3% (LPG). In 2018, in comparison to other regions of the country, in Western Pomerania the prices of fuel during holidays at distributors of gas stations are clearly higher. For Pb 98 in Pobierowo even PLN 5.62 / l was paid. The same fuel in Warsaw cost 4.91 PLN / l. This means a price difference of over 14.4% that is 0.71 PLN per liter of fuel.

The cost calculation for the motorway should include not only the profits of the owners and managers, but also the losses of customers (drivers and passengers) resulting from stops in front of the gates incurred on health by drivers and passengers, in addition fuel losses and pollution of the environment.

The nervousness and stress of drivers and passengers, on hot weekend days, trapped in cars standing in traffic jams in front of the gates on motorways, indicate a new big social problem. Fuel costs during forced stops and costs of harmful impact on the environment, polluted by the exhaust emissions of cars while waiting on the highway before the gates are enormous. The need to wait on the motorway ahead of the gates is an example of waste and deliberate harmful impact on the environment for disproportionate profits from tolls for the use of motorways.

Maximizing the profits for tolling the motorway has become the reason for the effects contrary to the principles of logistics. Waiting at the gate to drive through an average of about 3 hours on a 300 km motorway shows what price is paid by hundreds of thousands of drivers in traffic jams.

It does not take into consideration the lost time and health losses of drivers and co-passengers who are poisoned by exhaust fumes. Unnecessary nervousness destroys the values of a recreational trip. Some drivers give up such motorways and travel alternative routes where they do not have to pay tolls for using the motorway.

Costs of environmental pollution are underestimated and yet investment outlays for the construction of new gates will amount to about PLN 2 billion.

The cost of purchasing an existing charging system for using individual motorway sections (devices and software for gates) was PLN 5 billion.

It happens that in the time before Christmas, when more cars use the motorway that the waiting time at one point was over 45 minutes, and the traffic jam reached many kilometers. On the A2

motorway, where there are 4 toll gateways, the total waiting time for travel exceeds 3 hours. Payments in this system were independent of the number of kilometers driven. The problem concerned the section from Łądek (nearby Konin) to Nagłowice.

In 2014, all weekends in August, the toll road was free. This decision was taken by the government when thousands of drivers were stuck at the turn of July and August in multi-kilometer jams. It cost the government PLN 20 million.

On the sections of the A2 (Konin - Stryków) and A4 (Gliwice - Wrocław) motorways are managed by the General Directorate of National Roads and Motorways, and the manual issue of tickets to drivers has been introduced.

According to the concessionaire A4 (Stalexport Autostrada Małopolska SA) during the holiday season (July-August), the traffic on the motorway during the day was around 40,000. However, when collecting fees at gateways, it was limited to over 5 times.

The experience of the May weekend and the long June weekend (2015) showed that the gate capacity (after ticket issuing automatically at the entrance to the motorway) increased from 300 to 350 cars per hour.

In 2018 toll sections of motorways in Poland constitute 719.4 km. The cost of traveling for a passenger car on these motorways is PLN 154. Assuming that the gate capacity (after ticket issuing automatically at the entrance to the motorway) increased from 300 to 350 cars per hour, at the maximum intensity of traffic through toll gateways, it can pass (from 300 to 350) an average of 325 cars / h, i.e. 24h = 7,800 cars in a day.

When the fee for one car was PLN 154, theoretically the maximum revenue from all motorways in Poland from one day is:

$$7,800 \text{ alone} \times 154 \text{ PLN} = 1,201,200 \text{ PLN}$$

Fuel tax in Poland, which constitutes (30.6% excise tax, 18.7% VAT tax and 2.6% fuel surcharge) 51.9% of the fuel price.

The average fuel prices in Poland of 09/07/2018 are as follows:

Pb 98 petrol - 5.28 PLN / l,
Pb 95 petrol - PLN 5.02 / l,
diesel oil PLN 4.81 / l,
LPG PLN 2.0 / l

The average price of transport fuels in Poland $(5.28 \text{ PLN} + 5.02 \text{ PLN} + 4.81 \text{ PLN} + 2 \text{ PLN}) / 4 = 4.2775 \text{ PLN} / \text{l}$. The value of fuel tax on the average price of transport fuels is:

$$\text{PLN } 4.2775 / \text{l} \times 0.519 = \text{PLN } 2.22 / \text{l}$$

The official consumption of three transport fuels in Poland in 2016 exceeded 27 million m³. The tax on fuel in Poland is estimated at 51.9%. Assuming the price of 1 liter of transport fuel on average, PLN 4.2775 / l x 0.519, the value of fuel tax was calculated. The tax on fuel in Poland may reach a daily value:

$$(\text{average PLN } 2.22 / \text{l} \times 27,000,000,000 \text{ l} / 365 \text{ days}) = \text{PLN } 164,220,840$$

While the maximum daily revenue in Poland from all motorways may amount to PLN 1,201,200, in relation to the calculated value of tax on fuels from one day:

$$\text{PLN } 1,201,200 / \text{PLN } 16,220,220,840 \times 100\% = 0.73\%$$

With open gates on motorways in Poland, more than 5.5 times more cars could go faster without stops.

Waiting for the gate to drive an average of about 3 hours on a 300 km highway shows what price drivers pay in traffic jams.

When at weekends and in pre-holiday periods on motorways, 7,800 passenger cars move on motorways, which in a stopover in traffic jams burn an average of about 2l of gasoline per hour. A total of 7,800 cars in the time (from 1h to 3h) on average 2 hours of waiting before the gates burns on average $(7,800 \times 2 \times 5.6 \text{ l})$ about 87,360 l of fuel $(5 \text{ PLN} / \text{l}) = 436,800 \text{ PLN}$ a day.

The comparison shows that the ratio of charges collected on gates from passenger cars for tolls during the day is only 0.73% of the fuel tax, and after deducting the value of fuel burned unnecessarily during traffic jams in front of gates on motorways, this indicator it decreases to 0.46%.

The analyses carried out indicate that the construction of a toll collection system for passenger cars on motorways in Poland is economically and socially unjustified.

With each passing year, there are more cars and existing two-lane highways with existing gates, they effectively inhibit car traffic.

There are different rates on each motorway. Paid motorways in Poland use different tariffs. The price chaos that prevails on motorways in Poland requires a radical solution.

In 2014, opening the A1 gates cost the government PLN 20 million.

With open gates, the A1 motorway could pass more than 5.5 times more cars without stops, the highway customers would be satisfied, and the natural environment would not be poisoned without justification.

The charging of tolls in such conditions leads to negating the principles of logistics and ethics.

The need to stop cars before the gates increases the travel time, unnecessarily stresses drivers and increases the cost of fuel burned in traffic jams in front of the toll gate.

It is worth considering the issue of opening gates, on all Polish motorways on weekends and holiday days, and covering the costs of opening them with tax revenues from transport fuels. This cost is only 0, 73% of the value of this tax which flows into the budget, while price differences at petrol stations exceed 2.5 to over 14% of the fuel price. A stop of cars in front of the gates results in unjustified pollution of the natural environment with exhaust fumes and braking of vehicle traffic. Taking into account the yearly increase in the number of cars and the modest state of owning two-lane highways in Poland, the liquidation of gates on motorways would increase the liquidity of car journeys and reduce the scale of obstacles that currently exist.

4. CONCLUSIONS

1. Granting a concession for the operation of motorways and solving problems related to the collection of tolls by the concessionaires remains at the discretion of the Council of Ministers.

2. The analysis of toll costs on motorways in Poland indicates dubious benefits and unnecessary losses for the natural environment, as well as dissatisfaction of drivers and passengers. The high cost of fuel burned unnecessarily during stops at toll gate, driver and passengers being sentenced to long stops is unethical and contrary to the principles of logistics.

3. Some unsatisfied drivers choose alternative routes, so as not to get upset or pay fees. This intensifies the operation and degradation of regional and national roads.

4. For the purchase of the existing system for collecting tolls for use of motorways in Poland,

public money worth nearly PLN 5 billion has been spent, and current further investments in toll collection systems are estimated at PLN 2 billion. These expenditures are assessed as economically and socially doubtful.

5. When collecting tolls from the motorway, 300 to 350 cars per hour averaged 7,800 a day, and without charging at the same time could drive over $4 \div 5.5$ more cars.

6. The ratio between the value of possible maximum charges per day for passenger cars to the value of tax revenues from transport fuels is 0.73%, while price differences at petrol stations range from 2.5 to over 14% of the fuel price.

7. Taking into account the annual increase in the number of cars and the modest state of owning highways in Poland, it is worth considering opening gates and covering these costs with a tax on transport fuels.

REFERENCES

- [1] Blaik P., Logistyka. Koncepcje zintegrowanego zarządzania, PWE, Warszawa 2010
- [2] Błaszczak A., Etyka w biznesie popłaca, Rzeczpospolita B11, 31 March 2014.
- [3] Gasparski W., Błaszczak A., Szef powinien być wzorem, Rzeczpospolita B11, 31 March 2014.
- [4] Kacprzak Izabela, Odkorkować autostrady, Rzeczpospolita, 16 czerwca 2015, A3, rp.pl/kraj
- [5] Pichola I., Etyka w biznesie popłaca, Opinie, Rzeczpospolita B11, 31 March 2014.
- [6] Skowronek Cz., Sarjusz-Wolski Z., Logistyka w przedsiębiorstwie, PWE, Warszawa 2012, pp. 90-91
- [7] Szczepaniak T., Transport i spedycja w handlu zagranicznym, PWE, Warszawa 2002, p. 344.
- [8] <http://www.expressilustrowany.pl/aktualnosci/a/pl-atne-autostrady-w-polsce>
- [9] dr hab. Tomasz KOMORNICKI prof. PAN (kierownik zespołu) WPLYW BUDOWY AUTOSTRAD I DRÓG EKSPRESOWYCH NA ROZWÓJ SPOŁECZNO-GOSPODARCZY I TERYTORIALNY POLSKI
- [10] http://wartowiedziec.pl/attachments/article/18852/Raport_IGiPZ_PAN_prezentacja.pdf

Date submitted: 2018-09-07

Date accepted for publishing: 2018-09-28

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