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EVALUATION OF ECONOMIC DRIVING AS A COST-CUTTING STRATEGY

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Abstract. The development and renewal of the transport sector is a continuous and never-ending process. The technological **revolution** in the automotive industry has been discussed for a while. Vehicles with internal combustion engines, which are considered to be polluting, should be replaced by non-polluting or significantly less polluting ones. Recently, European countries are experiencing a major energy crisis. Both petroleum products and electricity are becoming more expensive, so vehicle consumers are increasingly asking the question, which is better: a vehicle with an internal combustion engine or an electric vehicle? This article examines the possibilities and perspectives of the development of electric vehicles in Lithuania, based on the best practices of other countries.

Keywords: eco-driving, fuel-consumption, costs, instruction

INTRODUCTION

Over past years, road transport enterprises have encountered a growing number of obstacles that have a substantial effect on their expenses. The aforementioned factors encompass a rise in vehicular traffic, a decline in safety, heightened competition, worldwide political and economic instability, rising fuel prices, a decrease in environmental pollution, the European Parliament's closure, the execution of CO2 emission reduction measures, a scarcity of drivers and their inexperience. The aforementioned challenges incentivize transportation companies to implement cost-cutting measures and comply with EU regulations. The economic driving measure is one of them. According to M. Bagavičius (2021), driving in an economical manner lowers fuel consumption, emissions of carbon dioxide into the atmosphere, and maintains road safety. Even truck manufacturers are spending a lot of money on the devices that are mounted on vehicles to assist guarantee safety and cut down on fuel usage. Enhancing the educational process would enable drivers to become more acquainted with the concept of economical driving. So the aim of the article – applying the economic driving principle to determine areas where transportation businesses might cut costs. The objectives of the research: To reveal the effect of economic driving on fuel consumption from a theoretical point view and use a digital transport management system to record the outcomes of test drives when fuel consumption is compared between economical and standard driving styles, identifying niches for reducing fuel consumption. Methods applied: analysis of scientific literature, experiment, secondary data analysis.

THE IMPACT OF ECONOMIC DRIVING ON THE COSTS OF TRANSPORT ENTERPRISES: THEORETICAL ASPECTS

Eco-driving (efficient driving) is a modern, driving style that allows moving according to the dynamics of traffic flow, but at the same time safely, saving the vehicle and reducing fuel consumption. The Swedish National Driving School coined the phrase for the first time in 1998 in Scandinavia (Caban *et al*. 2019) According to the authors, since 2001, the Netherlands, Germany, Finland, and Switzerland have all undertaken eco-driving initiatives Over the past ten years, this problem has been extensively covered in numerous international publications. If to be precise, in European countries, eco-driving is considered to be as a modern driving style and has been rapidly gaining popularity for more than a decade. The fundamentals of eco-driving apply to every type of vehicle (light, truck), regardless of the fuel type, gearbox, or driving expertise of the driver. Driving with an eco-driving mindset makes driving much safer and lowers the likelihood of getting into an accident. The literature review allows for the assumption of certain elements that might be regarded as the main benefits of eco-driving:

•Safety – lowers the risk of being involved in an automobile accident without impeding traffic and instead adjusts to driving conditions: of eco-driving keeps the driver able to work, is less likely to get into difficult situations, and experiences less stress (Jamson *et. al*, 2015; Nævestad, 2022);

•Economy – depending on the driver's skills, fuel consumption is reduced by about 15%, while at the same time it saves the vehicle, reduces operating costs, does not change much in insurance premiums, and may even be lower (Mclroy & Stanton, 2015; Allison *et al*. 2021; Huang *et al*., 2021 and ect.)

•Ecology – reducing fuel consumption leads to a corresponding reduction in pollution, negative impact on the environment, and ensures a better quality of life in society. Eco-driving is a sign of socially responsible companies (Huang *et. al*, 2018, Huang *et al*., 2021).

The fundamental guidelines for eco-driving are as follows, according to M. Bagavičius (2021):

- Moderate use of the car's electrical appliances;
- Timely gear shifting;

- Maintaining a constant speed;
- Correct acceleration and braking;
- Assessing the situation;
- Rolling using inertia and avoiding a full stop to an obstacle;
- Avoiding idling and turning off the engine in a timely manner.

According to Lois *et al*. (2019) the concept of eco-driving refers to a set of guidelines that deviate from standard driving practices and include driving at a relaxed pace, avoiding needless stops, being prepared, and getting rid of excessive idling. Other authors go into much more meticulous detail about the fundamentals of eco-driving. Sanguinetti, Kurani & Davies (2017) emphasize that in order to create a thorough and accurate definition and typology of eco-driving behaviors, the current research expands, synthesizes, and defines eco-driving in ways that are clear and explicit. Six mutually exclusive groups of behavior are included in the resulting typology: driving, cabin comfort, trip planning, load management, fueling, and maintenance. Huang, *et al*. (2018) argue that correct acceleration, driving speed, choice of route (assessment of the situation) and avoidance of idle are the basic principles of eco-driving. Therefore, M. Bagavičius's (2021) position essentially sums up the principles of eco-driving. So the authors of the article investigated whether and how economic driving principles may be made mandatory for transportation corporations in order to lower their costs. This goal stems from the widely held belief in the market that eco-driving is the domain of larger transportation corporations and that eco-driving is slow driving that falls short of profitability targets.

The most obvious indicator of a driver's level of eco-driving is the energy/fuel consumption of their vehicle. It is therefore not strange that the impact of eco-driving on fuel consumption to meet sustainable development goals is the topic that is most frequently covered in the academic literature (Caban *et al*. 2019; Lois *et al*. 2019; Xu *et al*. 2021; Li et al. 2020; Sarmadi *et al*., 2022 and etc.). A review of the literature also reveals that in the transportation industry, offering a service to a customer at the lowest feasible cost is crucial. Transportation companies are investing in new vehicles, technology, and personnel training in order to reduce fuel costs, emissions, and maintain road safety. However, economic driving is a strategy for accomplishing these objectives. Therefore, the results of this experiment reveals how the economic driving principles might be applied in transportation firms and is disclosed in the upcoming chapter.

METHODOLOGY

Defining the problem is an important step in organising the study. The issue relates to the statement that the absence of eco-driving in the delivery of transportation services raises the expense of travel and the amount of losses (damage to vehicles, cargo, damages, etc.) and is based on the idea that eco-driving is particularly one element of a cost-cutting strategy. The study's applicability is further reinforced by the fact that most academic publications concentrate more on the effects of fuel consumption reductions from an ecological standpoint. However, we argue, that fuel economy is the area for cost reduction and we describe this phenomenon's expression in detail. Experimentation was the selected research methodology. An experiment is when a researcher sets up a scenario wherein the effects of altering one of the related or independent variables on other components and variables in the system under investigation are noted. An artificially constructed environment is called an experiment, and it serves to both test potential solutions and aid in forecasting results.

On May 18, 2023, a Volvo truck and a Krone curtainsider semitrailer were used for the experiment. To add to the realism and make use of the inertia caused by weight, 20 tonnes of concrete blocks were piled onto the semi-trailer. The vehicle weighed 38 tons in all. The selected route was 71 km, of which 30 km were on motorways and the other distance was made up of towns and regional roads. There were a lot of speed bumps, smart traffic lights, regular and roundabouts, and a level crossing with a stop sign throughout the route and etc. There were about 20 kilometers of mountainous terrain on the trip. The experiment was carried out on the same day in order to preserve the most consistent weather possible. A new driver conducted two runs of the experiment and he was unaware of the application of economical driving principles and did not received instruction during the first run.

Acceleration, perceptiveness (stops, braking, extreme braking, use of vehicle inertia (rolling), use of terrain, obstacle evaluation, and use of support systems (autopilot, engine brake) were among the characteristics that were observed during the experiment as the academic literature suggests (Zhao et al., 2015; Bagavičius, 2021 and etc.). Observations made by the researchers (trip report analysis) and data recorded by the fleet management system are presented in the next chapter.

ANALYSIS AND INTERPRETATION OF THE RESEARCH FINDINGS

The experiment was designed to compare the performance of a driver who has not received any economic driving training. The driver drove the route in his usual manner the first time and with the assistance of an eco-driving instructor (following a quick lecture) the second time. Recorded and tracked trip characteristics are summarized in Table 1. The trips distance was 71.4 km and did not differed in both cases. Travel time on the first ride was1 hr. 30 min. 26 sec., the second one respectively 1 hr. 36 min. 08 sec. so differed for an objective reason: 2 minutes were spent at the level crossing to lower the train. The duration of the trip prove that economic driving is not a slow ride, as most drivers think. Average engine revs were: the first run 981 and the second – 1011, the between these two was 30 revs. The number of higher revs requires a higher fuel feed, so the main mistake of the driver was lack of experience as well as ignorance of the control of the vehicle.

Several more characteristics monitored were average speed (first run 53 km/h, and the second respectively 49 km/h) and average fuel consumption (40, 6 l/100 km and respectively 30,1 l/km).

Table 1

Trip Characteristics
(authors's own representation, based on the results of the experiment)

Run	Distance, km	Travel time	Engine revs	Average speed, km/h	Average fuel consumption, l/100 km
I	71,4	1 hr. 30 min. 26 sec.	981	53	**40,6**
II	71,4	1 hr. 36 min. 08 sec	1011	49	**30,1**

What led to such a result was the duration of rolling using inertia (first run – 8 min.59 sec. and the second respectively 2 min. 02 sec.) and engine shutdown at the traffic lights. It is advised by truck manufacturers to shut down the engine if a standstill lasts more than 30 sec. Truck uses about 2-3 liters of fuel per hour on average when rolling. It implies that the truck uses less fuel the more inertia it employs. In addition to reading a topographic map and choosing the appropriate driving mode based on the terrain, autopilot usage aids in maintaining a steady speed.

Factors like the quantity of stops, the amount of extreme stops, and the number of stops altogether impact the driver's insight. When truck slows down more quickly than 3 m/s, it is considered to be an extreme braking. There were 17 complete stops, 69 stops, extreme braking 3, and 22 brakes during the first run. After the instruction the situation changed: there were observed 11 stops and no one extreme braking at all. When the engine brake is utilized properly, it doesn't use fuel so the instructor's help greatly decreased the amount of times the brake was applied, which also lowered operating costs.

The average position of the accelerator during the first run was 56 percent and the second – 48 percent, the difference was 8 percent. During the first run the driver at least once pressed the accelerator pedal to the maximum so the system recorded a 100 percent click. During the second run the maximum click was 90 percent. Also, the driver also reduced the number of accelerations: acceleration was recorded at 284 during the first run and 212 during the second. Moreover, the driver employed rolling downhills and accelerated on climbs in steep regions. Because fuel consumption is always lower in hilly terrain so it is always vital to take advantage of the acceleration on slopes. Additionally, the higher the gear on an incline, the more torque the engine can produce when maintaining speed.

The findings demonstrated that adequate driver readiness, which includes a breakdown of the most frequent errors that may be avoided, reduces fuel consumption, guards against damage, and lowers operating expenses.

CONCLUSIONS

1. The paper presents eco-driving as a comprehensive solution that tackles safety, economic, and environmental issues. It does this with compelling precision. The adoption of this modern driving style, independent of fuel type or driving experience, can lead to increased road safety, reduced fuel consumption, and support for environmental sustainability, as the authors stress. The eco-driving framework's integration of economy, environment, and safety portrays it as a comprehensive strategy that helps society as a whole in addition to individual drivers.
2. The paper explores the compelling idea of requiring transportation companies to adhere to eco-driving principles, dispelling the myth that these practices are exclusive to larger enterprises. The authors address a major business trouble – fuel usage and operating expenses – by examining how eco-driving might be used to cut costs for transportation companies. While many academic publications focus primarily on the environmental implications of fuel consumption reductions, this study contends that fuel economy plays a pivotal role in overall cost reduction.
3. Experimentation, the selected research methodology, gives the study a useful and practical component. Through the use of a Volvo vehicle and a Krone curtainsider semitrailer loaded with twenty tons of concrete blocks, the researchers were able to simulate real-world conditions and the difficulties encountered in real-world transportation operations. The incorporation of diverse road characteristics, such speed bumps, intelligent traffic signals, circular intersections, and hilly topography, amplified the relevance of the results in actual driving scenarios.
4. Adopting eco-driving techniques in the transportation business was supported by compelling results from an experiment undertaken to assess the effect of eco-driving training on a driver's performance. Significant gains in a number of trip features are demonstrated by comparing two runs: one in which the driver drove normally and the other with the help of an eco-driving instructor.
5. The results are very supportive of the transportation industry implementing eco-driving instruction. The improved maneuverability of the driver is demonstrated by the changed accelerator position, less accelerations, and calculated application of rolling descents and acceleration on ascents. In addition to utilizing autopilot and comprehending the terrain, these modifications highlight how crucial driver preparation and training are to reducing fuel consumption and operating costs.

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