



# Eco-Driving: The Path to Sustainable Transport Within the Framework of the Green Transition on the Example of the Republic of Belarus

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## Abstract

In the article, the authors' definition of the concept “eco-driving” as a practical, quickly implemented and low-cost tool for sustainable transport within the framework of the green transition, combining environmental efficiency (reduced harmful substances emissions), economic efficiency (fuel savings, reduced vehicle maintenance and repair costs, extension of the vehicle components and assemblies service life) and social efficiency (improved road safety, reduced road accidents, formation of an environmental culture) has been clarified and scientifically substantiated. The study covers current issues related to the eco-driving principles, reflects the relationship of eco-driving with sustainable transport, green transition and sustainable development goals. It is proposed to implement the eco-driving business process in the activities of transport organizations of the Republic of Belarus: the proposed business process with the image of a context diagram has been developed; the choice of key criteria for eco-driving assessment has been substantiated; a system for assessing eco-driving and driver motivation has been created; savings from the introduction of eco-driving have been reflected. In order to scale up the project on the introduction of eco-driving in the activities of transport organizations of Belarus, a roadmap with visualization in the form of a Gantt chart has been developed. The results obtained allow us to expand the understanding of eco-driving as a key element of sustainable transport within the framework of the green transition. The introduction of eco-driving in the activities of transport organizations of the Republic of Belarus will contribute to environmental sustainability, increasing economic efficiency, and increasing social responsibility.

**Keywords:** eco-driving, green transition, sustainable transport, sustainable development goals, business process

## 1.Introduction

Relevance and problems of the study. Sustainable transport based on the practice of eco-driving is becoming an important scientific and practical research area in the context of modern green transition trends. Its relevance and problems are due to global challenges related to climate change, environmental pollution, resource depletion and the increased need for sustainable development within the framework of the green transition.

Transport is one of the main sources of air pollution. Every year, the amount of CO<sub>2</sub> dioxide (CO<sub>2</sub>) emissions resulting from transport activities amounts to more than 8 Gt CO<sub>2</sub>. In 2023, CO<sub>2</sub> emissions from fuel combustion in the transport sector accounted for 25% of total emissions, with road transport accounting for more than 75%. In 2023, road vehicles were the largest polluters, accounting for three-quarters of all transport-related emissions. Emissions from cars have increased by around 20% over the past ten years to 3.2 Gt CO<sub>2</sub>, making them the largest source of road transport emissions globally. Heavy-duty trucks are also major polluters, emitting around 2 Gt CO<sub>2</sub> annually worldwide (Statista, 2023).

Transport was also the second largest source of global greenhouse gas emissions, with cars polluting the most (15%) (Statista, 2023).

In the Republic of Belarus, about 70% of air pollution comes from road transport, which has a negative impact on the sustainable transport development. At the end of 2023, more than 11.2 thousand organizations of various forms of ownership and more than 36 thousand individual entrepreneurs operated in the belarusian transport complex. At the same time, the number of vehicles belonging to organizations and in the citizens personal ownership at the end of 2023 amounted to more than 4,2 million units (of which 73,5% were passenger cars, 8,9% were trucks) (National Statistical Committee of the Republic of Belarus, 2025).

Pollutants emissions into the atmospheric air of Belarus at the end of 2023 amounted to 897.9 thousand tons (98 kg per capita), including 408.4 thousand tons (44 kg per capita) from mobile sources. At the same time, in 2023, there was a dynamic in pollutants emissions into the atmospheric air from mobile and stationary sources (the growth rate by 2022 was 102.9%) (National Statistical Committee of the Republic of Belarus, 2024).

Given the understanding of the problems' importance, priority attention should be given to the greening of transport at present, as it is directly related to the key challenges of our time. The study proposes to use eco-driving as a key element of sustainable transport, which has significant potential for reducing the carbon footprint, increasing the transport energy efficiency (reducing fuel consumption, increasing the vehicles service life), and increasing economic and social efficiency.

However, in the Republic of Belarus there is no practice of using eco-driving due to low awareness and insufficient motivation, technical and technological limitations, economic barriers, organizational and managerial problems, regulatory aspects, weak government support.

In this regard, the aim of the study is to provide theoretical justification and develop practical recommendations for the implementation of the business process "eco-driving" in the activities of transport organizations of the Republic of Belarus, as a key element of sustainable transport within the framework of the green transition.

The aim of the study determined the formulation and solution of the following tasks:

- to explore the economic essence of the concept "eco-driving", to propose an original definition of the concept from the point of view of sustainable transport within the framework of the green transition;
- study and supplement the principles of eco-driving as a sustainable transport element;
- implement the business process "eco-driving" in the activities of a transport organization based on the example of Rising Ltd.: justify the choice of key criteria for assessing eco-driving; create a system for assessing eco-driving and motivating drivers; reflect the economic effect of implementing this business process - savings in fuel costs and replacement of vehicle components and assemblies; substantiate the importance of training employees in eco-driving;
- develop a roadmap for the introduction of eco-driving into the activities of transport organizations of the Republic of Belarus.

The scientific novelty of the obtained results is emphasized by the importance of eco-driving as an element of sustainable transport within the framework of the green transition, and the proposed recommendations will contribute to the formation of an environmental culture, a reduction in environmental impact, an increase in economic and energy efficiency, and an improvement in the life quality of the population. This is an important step towards green transition and achieving sustainable development goals.

The object of the study is eco-driving as an element of sustainable transport within the framework of the green transition. The subject of the study is recommendations for the introduction of eco-driving in the activities of transport organizations of the Republic of Belarus.



## 2. Materials and Methods

The identified problems were identified based on the results of a comparative analysis of domestic and foreign literature reflecting the relevance of environmental issues, the eco-driving effectiveness; an oral survey in transport organizations engaged in freight road transport.

In studying approaches to defining the essence of the concept “eco-driving”, an analysis of the definitions by foreign and domestic authors was used, based on which, using the methods of deduction and induction, the author’s definition of the concept of “eco-driving” was proposed from the point of view of sustainable transport within the framework of the green transition.

To assess the effectiveness of eco-driving, authors used statistical and comparative methods to analyze data on harmful emissions, fuel consumption. Summarizing the obtained research results, based on the application of mathematical and statistical methods, the choice of key criteria for assessing eco-driving was substantiated; a system for assessing eco-driving and driver motivation was created; the effect eco-driving implementation was calculated. In order to scale up the project, a roadmap for introducing eco-driving into the activities of belarusian transport organizations was developed with visualization in the form of a Gantt chart.

Thus, the study used complementary general scientific (classification, comparison, explanation, induction and deduction, scientific proof, logical, comparative methods of analysis) and specific methods of cognition (generalization, graphic), as well as systemic and comprehensive approaches.

The theoretical basis of the research is the study and systematization of scientific publications of domestic and foreign scientists on eco-driving, statistical data on environmental damage; industry reports, international and national regulatory legal acts; internet sources, which made it possible to make a theoretical selection and determine the main research topic.

## 3. Results

The term “eco-driving” was first used in 1998 by the Swedish National Driving School (Caban, Vrabel, Šarkan, & Ignaciuk, 2019). Since then, researchers have begun to study the characteristics of eco-driving. As a result of the analysis of the authors' opinions regarding the concept under study, we identified three approaches found in the literature:

1. Ecological and energetic - a comprehensive approach that essentially combines the concepts of “eco-driving”, energetic (fuel efficiency) and environmental aspects (reduction of emissions, minimization of environmental impact). This approach is the most common in specialized and scientific literature. Barkenbus (2010), Martin, Chan & Shaheen (2012), Barth & Boriboonsomsin, (2009), Ahlstrom & Kircher (2017), Sivak & Schoettle 2012), Ayyildiz, Cavallaro, Nocera & Willenbrock (2017) focus on reducing fuel consumption and harmful emissions through optimizing driving style. Eco-driving as a tool for reducing vehicle fuel and energy consumption is considered by Fafoutellis, Mantouka & Vlahogianni (2021), Hsu, Lim & Yang (2017), Mensing, Bideaux, Trigui, Ribet & Jeanneret (2014). Eco-driving as a tool for reducing hazardous emissions into the atmosphere is considered by Kutzner, Kacperski, Schramm & Waenke (2021).

Barkenbus, J. N. (2010) defines eco-driving as a driving strategy that minimizes fuel costs and emissions without significantly increasing travel time.

Sivak & Schoettle (2012) emphasize that eco-driving allows to reduce fuel consumption by 5–20% depending on the type of road.

Gudkov (2018) considers eco-driving as an element of “green logistics” and notes that driver training can reduce fuel consumption by 10–15%.

This approach corresponds to the principles of systems analysis, reflects the dual nature of eco-driving, is used in modern research, and is supported by the international regulatory framework.

2. The behavioral approach to the essence of the eco-driving concept focuses on the human factor as a key element of efficient and environmentally friendly driving. The idea of the approach is to form long-term driver habits through training and motivation (Zarkadoula, Zoidis, & Tritopoulou, 2007), (Ayyildiz et al., 2017), (Fafoutellis et al., 2021), (Dehkordi, Larue, Cholette, Rakotonirainy, & Rakha, 2019), (Sanguinetti, Kurani, & Davies, 2017). This approach is simple and accessible, but requires personal discipline from the driver, interest in maintaining economical and at the same time more environmentally friendly driving. The impact of eco-driving on road safety is considered by Alam & McNabola (2014), Ahlstrom & Kircher (2017), Nævestad (2022). The authors Af Wåhlberg, (2007), Caban et al. (2019) in their definitions note the simultaneous achievement of environmental and transport-safety efficiency, which is a certain advantage of the approach.

3. The technological approach to the essence of the concept of eco-driving emphasizes that the use of modern technologies transforms eco-driving from a subjective driving style into a controlled, measurable and automated process. This approach combines engineering solutions, telematics and artificial intelligence to achieve maximum fuel efficiency and environmental friendliness. Ayyildiz et al. (2017), Barić, Zovak, & Periša, (2013) believe that automating the process will allow to obtain accurate data and achieve greater results from the use of eco-driving.

Despite the existence of various studies in the field of reducing vehicles fuel consumption, the concept of “eco-driving” in the Republic of Belarus appeared relatively recently, hence there is an almost complete lack of publications on this issue. Among Belarusian authors, one can note the works of Meshcheryakova & Kryukova (2023), who consider eco-driving as a tool for increasing the economic efficiency of transport organizations due to savings in fuel consumption and vehicle repairs.

In the studies of Prozorov & Zakharov (2020), Kolacheva & Chertakova (2017), Lenich (2024), Smirnov (2023) the issues of reducing fuel consumption when introducing eco-driving are considered, and eco-driving is mentioned as an effective tool for reducing the environmental burden.

Based on the analysis of literary sources, we have clarified the existing concepts and proposed a comprehensive author’s definition: “eco-driving is a practical, quickly implemented and low-cost tool for sustainable transport within the framework of the green transition, combining environmental efficiency (reduced CO<sub>2</sub>, greenhouse gases and solid particles emissions, reduced noise), economic efficiency (fuel savings, reduced vehicle maintenance and repair costs, extended vehicle components and assemblies service life) and social efficiency (improved road safety, reduced road accidents, formation of an environmental culture)”. We believe it is necessary to consider eco-driving as a fast and low-cost way to reduce the transport carbon footprint without radical changes to the infrastructure. This makes it a key element of sustainable transport within the framework of the green transition and achieving the Sustainable Development Goals (SDGs):

#### 1. Connection with sustainable transport:

- reducing emissions: eco-driving aims to optimize driving style to reduce fuel consumption and, as a result, CO<sub>2</sub>, greenhouse gases and solid particles emissions. This is a key element in the transition to sustainable transport with a lower environmental impact;
- increasing efficiency: eco-driving involves using optimal speed, smooth acceleration and braking, and the correct choice of gears, which will improve fuel efficiency and reduce overall operating costs;
- extending vehicle life: smoother, gentler driving reduces engine, brakes, tires and other components wear, resulting in longer vehicle life and lower maintenance and replacement costs.

#### 2. Connection with green transition:

- reducing dependence on fossil fuels: eco-driving helps reduce fuel consumption, which not only helps reduce emissions but also reduces dependence on fossil fuels and encourages the transition to alternative energy sources;



- closed-loop economy: increasing the resources for auto components;
- developing environmental awareness: the introduction of eco-driving promotes the environmentally responsible behavior development among drivers and increases their environmental issues awareness;
- supporting the electric vehicles and other clean technologies adoption: eco-driving can be integrated into driver training programs for electric vehicles and other low-emission vehicles to maximize their efficiency and minimize their environmental impact.

### 3. The development of sustainable transport is linked to the following SDGs:

- SDG3: ensure healthy lives and promote well-being for all at all ages (reduce the carbon footprint, the less emissions, the cleaner the air; the number of diseases and deaths from exposure to air pollution will be reduced);
- SDG7: ensure universal access to affordable, reliable, sustainable and modern energy for all (increase the energy efficiency of freight transport; reduce emissions and improve air quality);
- SDG9: build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation (the introduction of eco-driving can stimulate the development and implementation of innovative technologies in the field of transport, the development of smart driver assistance systems);
- SDG11: make cities and human settlements inclusive, safe, resilient and sustainable (improving air quality and reducing congestion and noise in cities, making cities more livable; cities sustainability: eco-driving is a component of sustainable transport and sustainable urbanization);
- SDG12: ensure sustainable consumption and production patterns (eco-driving promotes more efficient use of resources (fuels), reduces waste and promotes the transition to more sustainable consumption patterns; vehicles service life increase, transport resource intensity reduction: development of a circular economy in the auto industry; optimization of logistics operations in transport activities, use of multimodal transportation);
- SDG13: take urgent action to combat climate change and its impacts (eco-driving helps reduce CO<sub>2</sub>, greenhouse gases and solid particles emissions, which is a direct contribution to the fight against climate change and its impacts; research analysis has shown that if 10% of drivers switch to eco-driving, global CO<sub>2</sub> emissions from transport will decrease by 1.5%) (United Nations, n.d.).

Thus, eco-driving is not only an element of sustainable transport, but also part of the strategy for the transition to a low-carbon economy; it contributes to achieving the SDGs – which is the core of the green transition strategy.

Contribution to the green transition and achievement of the above-mentioned SDGs can be made by adhering to the basic eco-driving principles (IRU, n.d.):

1. Optimal engine control:
  - smooth acceleration: maintaining engine revolutions in the “green” sector on the tachometer of the vehicle’s dashboard;
  - use of higher gears: preferential movement in higher gear, quick switching to higher gears when speed increases;
  - minimizing idling: reducing engine idling to a minimum, turning off the engine when stopped for more than 30 seconds.
2. Movement dynamics:
  - maintaining a constant vehicle speed (optimal speed provides 8–10% fuel savings), using cruise control, avoiding speeding;
  - predictive driving, preparing in advance for changes in traffic conditions (upcoming stops, slowdowns or turns);
  - smooth driving style leads to 12–15% fuel savings; minimal use of emergency braking;
  - selection of the optimal route to reduce mileage and stops in traffic jams and at traffic lights, combining several short routes.
3. Vehicles technical preparation:
  - regular monitoring of tire pressure will allow for safe driving, reduce road resistance, reduce tire wear and fuel consumption (optimal tire pressure provides 3–5% fuel savings);

- reduction of “useless” vehicle load – heavy tools, unused pallets and other unnecessary items (every 100 kg increases fuel consumption by 5–7%).

4. Climate adaptations:

- winter operation – warm up the engine for no more than 5 minutes, use of viscous oils;  
 - summer operation – reducing the time of air conditioning use, optimal air conditioning at 22–24°C (every degree lower will lead to increased fuel consumption), using natural ventilation at low speed.

5. Psychological aspects:

- peripheral vision training;  
 - motivational mechanisms: financial incentives (for fuel consumption savings).

6. Technological aspects:

- application of a real-time recommendation system on fuel economy and driving habits;  
 - eco-mode scale on the instrument panel.

It has been proven that regular application of eco-driving principles increases vehicle life by 20–30%.

Thus, it can be noted that the principles of eco-driving as an element of sustainable transport are closely interconnected and form a single complex system that allows for an environmental effect (reduction of emissions into the environment), an economic effect (reduction of operating costs, resource conservation, increased energy efficiency) and a social benefit (reduction of accidents, reduction in the number of diseases and deaths from exposure to polluted air).

However, despite the potential benefits, there is no eco-driving practice in Belarus for a number of reasons:

- low awareness. Lack of information remains the main obstacle to the eco-driving implementation in transport organizations. Driving schools do not pay attention to eco-driving, transport organizations do not conduct training for drivers. Many heads of transport organizations do not see a direct financial benefit (delivery times prevail in transportation, not fuel savings; strict delivery schedules force drivers to use an aggressive driving style);

- insufficient motivation, organizational and management problems. Many drivers prefer to use familiar driving methods. Insufficient drivers’ motivation is due to the fact that their salaries do not depend on fuel savings; there are no bonuses for drivers who follow eco-driving principles. Transport organizations lack a systematic approach, there are no corporate standards or KPIs for eco-driving; - technical and technological limitations. High-mileage vehicles are difficult to adapt to eco-modes; lack of smart driver assistance systems. Lack of software for analysis: few local IT solutions for monitoring driving style; foreign systems are expensive and not always adapted;

- economic barriers. The implementation of GPS devices, telematics, training of employees and drivers requires financial investments, small businesses are not ready to spend money on the project, since they do not see a direct financial benefit;

- regulatory aspects. Lack of mandatory standards: there is no legislative definition of eco-driving, the traffic regulations do not contain clear criteria for the “eco-style” of driving, and there are no requirements for training drivers. For example, National Strategy for Sustainable Development of the Republic of Belarus until 2035 (2020) provides measures to develop communication routes, ground infrastructure, the transition to alternative fuels. At the same time, it does not mention eco-driving;

- weak government support: lack of tax breaks (transport tax reduction) and subsidies for “green” carriers, etc.

Based on the conducted research, we consider it necessary to implement eco-driving in transport organizations of Belarus. Let us consider implementation of “eco-driving” business process on the example of Rising Ltd. It will include constant use of eco-driving principles; daily operations for collecting and analyzing data on each vehicle through the GPS; the eco-driving assessment system proposed by the authors; informing drivers about KPIs weekly; compiling monthly reports, calculating monthly drivers’



bonuses (fines) for (non)compliance with eco-driving principles. The “eco-driving” business process context diagram, compiled using the software product AllFusion Process Modeler r7, is shown in figure 1.

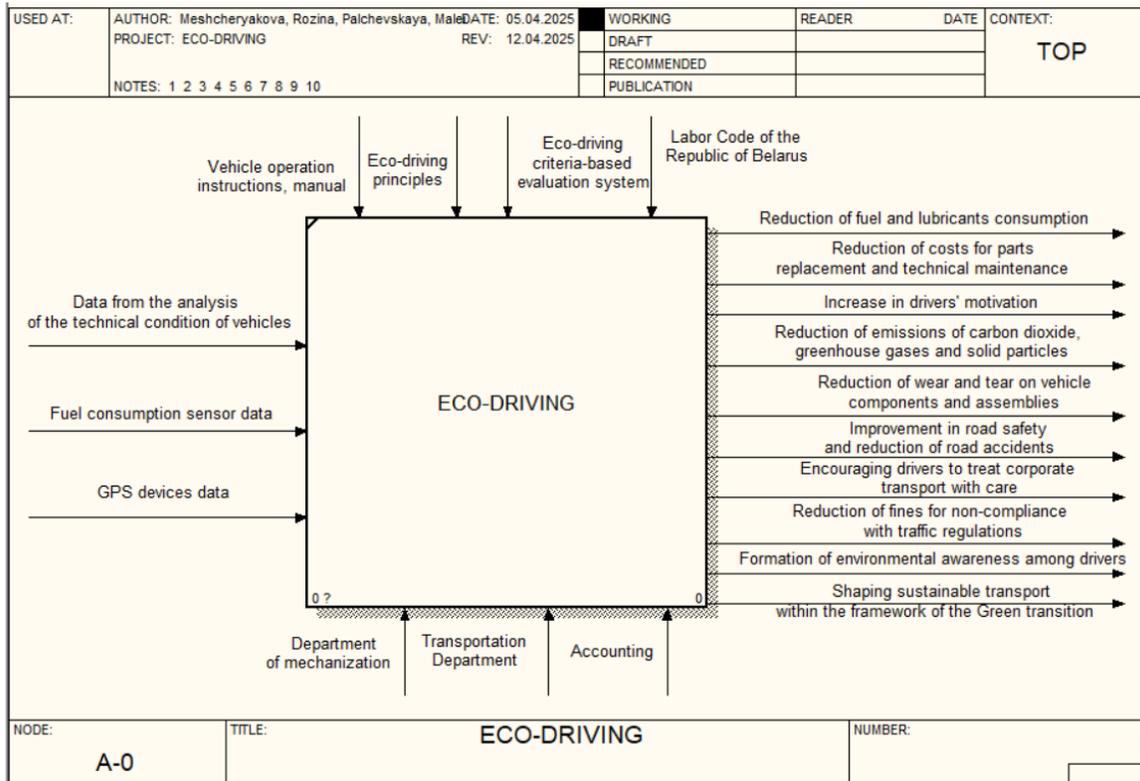


Figure 1. The “eco-driving” business process context diagram

Let's calculate the effect of implementing the “eco-driving” business process at Rising Ltd.

The vehicle fleet of Rising Ltd. consists of 163 vehicles. However, only 100 vehicles are equipped with GPS devices, which will be require expenses to implement GPS for 63 vehicles. The cost of installing one GPS device is 406,25 US dollars. The organization has 163 drivers in total, the average salary of one driver is 900 US dollars.

Eco-driving involves monitoring the control parameters of vehicle operation and assigning eco-scores to the driver according to established criteria. The following are selected as the key criteria for assessing the effectiveness of eco-driving:

- adaptive cruise control. Allows you to automatically maintain the required vehicle speed. As a result, fuel consumption decreases;
- idling. It is recommended to warm up the engine before starting to move for no more than 5 minutes and start moving, smoothly reach cruising speed and the engine will warm up effectively;
- coasting. When coasting, fuel is used minimally to maintain the engine idling;
- engine revolutions. Each truck has its own economic engine revolutions mode - the “green” zone, which is reflected on the tachometer on the vehicle's instrument panel. When driving, the engine revolutions should be in the “green” zone. Exceeding it, the torque decreases along with the power, and fuel consumption increases;
- engine braking. Use of a retarder, a device designed to reduce the speed of a vehicle without using the main braking system. When braking with the engine, fuel is not used and the braking system (brake discs and pads) operates in a gentle mode;
- fuel consumption – a key indicator of eco-driving. Fuel consumption increases with sharp acceleration and braking of the vehicle, at high speed, when driving in low gears, with irrational air

conditioner use (climate control), when the vehicle is overloaded, long engine warm-up in winter, with an aggressive driving style.

Thus, the eco-driving assessment system proposed by the authors includes such key criteria as adaptive cruise control, idling, engine load, engine revolutions, fuel consumption. Each criterion is assigned a certain number of eco-points, in accordance with the technical characteristics of the vehicles (tables 1, 2).

*Table 1. Scale for converting fuel consumption into eco-points*

Fuel consumption, liters/100 km	Number of eco-points, points
<b>Scania R440</b>	
32 and more	0–75
30–31	76–90
29 and less	91–100
<b>Volvo FH16</b>	
35 and more	0–75
32–34	76–90
31 and less	91–100
<b>Mercedes 1844LLS</b>	
34 and more	0–75
31–33	76–90
30 and less	91–100

*Table 2. Evaluation system for key eco-driving criteria, eco-points*

Criterion	Eco-points by vehicle brands		
	Scania R440	Volvo FH16	Mercedes 1844LLS
Adaptive cruise control	65–100	60–100	60–100
Idling	70–100	65–100	60–100
Engine load	60–100	60–100	65–100
Engine revolutions mode	60–100	75–100	75–100
Fuel consumption	75–100	75–100	75–100

Drivers who have mastered and applied eco-driving principles will gain higher eco-points, receiving a monthly bonus. If drivers do not comply with eco-driving rules, they will have low eco-points, thus receiving a fine (Table 3).

*Table 3. Driver incentive system for eco-driving*

Vehicle brand	Total eco-points	Salary bonus (fine) as a percentage of monthly salary
Scania R440	0–200	(10%)
	201–330	(5%)
	331–414	5%
	415–480	10%
	481–500	15%
Volvo FH16	0–205	(10%)
	206–335	(5%)
	336–415	5%
	416–485	10%
	486–500	15%
Mercedes 1844LLS	0–205	(10%)
	206–335	(5%)



	336–415	5%
	416–485	10%
	486–500	15%

It's assumed that the mechanics will receive information on each vehicle daily via the GPS and enter data according to the key criteria for assessing eco-driving into rating tables for each vehicle. The mechanics will summarize the drivers' indicators weekly, assign overall eco-scores according to the adopted eco-driving assessment system, inform the drivers about the (non-)achievement of eco-driving indicators at the end of each work week. Then, the mechanics summarize the data (overall eco-score for each driver) monthly to provide information to the accounting department. The accountant will review the summary table with overall eco-scores for each driver every month to calculate bonuses or fines for (non-)compliance with eco-driving rules.

The benefits of eco-driving for transport organizations have been proven and the effect of eco-driving has been quantified in scientific studies. Thus, the practice of introducing eco-driving shows fuel savings of up to 20%, and in some cases up to 30% (depending on the mileage of the vehicles and operating conditions).

Next, we calculate the savings on fuel costs after the introduction of eco-driving in Rising Ltd., based on average fuel consumption savings of 10% (table 4).

*Table 4. Calculation of fuel cost savings at Rising Ltd.*

Vehicle brand	Quantity, units	Annual fuel consumption, l		Fuel savings, l	Annual fuel cost savings (excluding VAT), US dollars
		actual value for 2024	after the introduction of eco-driving		
Scania R440	50	11725000	10552500	1172500	721820.32
Mercedes 1844LLS	63	15876000	14288400	1587600	977366.25
VOLVO FH16	50	12950000	11655000	1295000	797234.37
Total:	163	40551000	36495900	4055100	2496420.94

Based on the calculations, it can be seen that fuel savings at Rising Ltd. could amount to 4055100 liters per year, which directly reduces emissions of CO<sub>2</sub> and other pollutants, and in the long term, eco-driving could become a key tool for achieving the goals of the green transition.

Next, we will analyze the effect of replacing vehicle components and assemblies.

The vehicle driving style directly affects driving safety, wear of parts. Some parts last much longer with a smooth driving style (following the principles of eco-driving increases the mileage of the vehicle before the next repair or maintenance), while an aggressive driving style leads to accelerated wear and more frequent replacement of parts, which increases the cost of maintenance (Nogin & Butkov, 2004).

As an example, we will examine the replacement of the main vehicle components and assemblies, the wear of which directly depends on eco-driving:

- brake system (brake pads, brake discs). When eco-driving, engine braking is recommended, which reduces the load on the brake system;
- engine and its components. High revolutions and sudden loads increase wear of the VT mechanism; eco-mode reduces thermal overloads, reducing the risk of ring sticking and wear of piston group liners and engine cylinders;
- transmission. Smooth gear shifting reduces wear on the clutch disc on a MT; abrupt starts and "throwing" the clutch lead to its rapid overheating. Smooth gear shifting reduces the load on the gears and

synchronizers on gearboxes; aggressive acceleration can lead to premature wear of the friction clutches in an AT.

The calculations do not take into account a complete engine replacement, we conditionally assume that vehicles with this breakdown will be sold. However, repair of some engine components will be carried out by mechanics at the organization.

Let us assume that the maximum mileage of vehicles at the organization will be 900000 km, after which the vehicles will be sold. The conditional vehicles mileage requiring components and assemblies' replacement before and after the introduction of eco-driving is presented in table 5.

*Table 5. Conditional vehicles mileage requiring components and assemblies' replacement before and after the introduction of eco-driving, km*

Name	Conditional vehicles mileage requiring components and assemblies' replacement		Changes
	before implementing eco-driving	after implementing eco-driving	
Brake system	every 60000	every 80000	20000
Engine components	up to 500000	up to 900000	400000
Transmission (clutch kit)	every 450000	every 650000	200000
Total:	-	-	620000

As a result, it is clear that after the introduction of eco-driving, the mileage of vehicles increased for each component and assembly considered for replacement.

In table 6 the calculation of savings due to the increase in the mileage of the vehicle before the next replacement of components and assemblies is presented.

*Table 6. Savings due to increasing the vehicle mileage before the next components and assemblies' replacement, US dollars*

Vehicle brand	Name of the component, assembly	Approximate cost of components, assemblies	Cost of replacement of components, assemblies		Savings on replacement of components, assemblies
			before implementing eco-driving	after implementing eco-driving	
Mercedes 1844LLS	Brake system	468.75	7031.25	5156.25	1875
Volvo FH16		390.63	5859.38	4296.88	1562.5
Scania R440		562.5	8437.5	6187.5	2250
Total:	-	-	21328.13	15640.63	5687.5
Mercedes 1844LLS	Engine components	1312.5	2625	1312.5	1312.5
Volvo FH16		1156.25	2312.5	1156.25	1156.25
Scania R440		1718.75	3437.5	1718.75	1718.75
Total:	-	-	8375	4187.5	4187.5
Mercedes 1844LLS	Transmission (clutch kit)	1875	3750	1875	1875
Volvo FH16		1500	3000	1500	1500



Scania R440		968.75	1937.5	968.75	968.75
Total:	-	-	8687.5	4343.75	4343.75
TOTAL:	-	-	38390.63	24171.88	14218.75

Therefore, it is clear that after the introduction of eco-driving, the savings due to the increase in the vehicle mileage before the next components and assemblies' replacement will amount to 14218.75 US dollars.

Personnel training is an important stage, since the result of the implementation of eco-driving will depend on the awareness of mechanics, the knowledge gained by drivers about the eco-driving principles and their practical application.

It is assumed that training of mechanics will take place at Rising Ltd. through invited specialists working at specialized service centers maintaining vehicles owned by the transport organization. Mechanics will be trained in technical characteristics of vehicles; use of eco-driving monitoring systems; practical recommendations on eco-driving; eco-driving assessment system. The cost of training three mechanics will be 1406.25 US dollars, including obtaining lectures, practical and video material for subsequent training of drivers.

It is proposed that driver training be carried out through mechanics at Rising Ltd., through lectures, video materials, and practical advice on eco-driving (for drivers with low eco-scores, weekly information and repetition of theoretical material, viewing of video material are proposed).

Thus, with the constant income from the provision of transport services by Rising Ltd., it is clear that the resulting savings on fuel and replacement of vehicle components and assemblies will cover all costs associated with the implementation of eco-driving: one-time (for training mechanics, installing GPS devices) and current (costs for driver bonuses).

The introduction of eco-driving also contributes to the increase of environmental awareness of society: environmentally responsible behavior is formed in drivers, their awareness of environmental problems increases, which is especially relevant in the context of the green transition. The correct application of eco-driving principles not only reduces fuel consumption and costs for repair and maintenance of vehicles, but also improves road safety, reduces the likelihood of accidents, and minimizes the impact of harmful substances on the environment, which speaks not only of the economic and social, but also the environmental effectiveness of eco-driving.

Let us display the strategic plan for the eco-driving implementation in the activities of belarusian transport organizations in the form of a road map, in table 7.

*Table 7. Roadmap for the implementation of eco-driving in the Republic of Belarus*

Stage	Aim	Tasks	Deadlines	Responsible
<b>1. Preparatory stage</b>				
1.1 Setting goals	Development and approval of the National Program for the Sustainable Transport Development in the Republic of Belarus (containing a chapter on eco-driving)	- introduction of the legislative term “eco-driving”, including in traffic regulations; - formation of environmental culture; - transport decarbonization; - environmental situation improvement: reduction of emissions into the environment, congestion and noise reduction;	10 months	Council of Ministers of the Republic of Belarus, Ministry of Transport and Communications of the Republic of Belarus, Ministry

		<ul style="list-style-type: none"> <li>- road safety improvement;</li> <li>- government support: development of tax incentives or subsidies for “green” carriers;</li> </ul>		of Economy of the Republic of Belarus, Association “BAMAP”
1.2 Creating mandatory eco-driving standards	Developing corporate standards or KPIs for eco-driving	<ul style="list-style-type: none"> <li>- informing managers of transport organizations about economic, social and environmental efficiency;</li> <li>- selection of key performance indicators for assessing eco-driving;</li> <li>- development of corporate standards or KPIs for eco-driving;</li> <li>- application of the Instructions for the operation of vehicles using the principles of eco-driving, taking into account the vehicles technical features;</li> <li>- creation of a memo on eco-driving;</li> </ul>	2 months	Association "BAMAP"
<b>2. Implementation of eco-driving</b>				
2.1 Employee training	Theoretical and practical training of employees: mechanics, drivers	<ul style="list-style-type: none"> <li>- training of those responsible for eco-driving in the technical features of vehicles, collection and analysis of data on key performance indicators for assessing eco-driving;</li> <li>- obtaining theoretical knowledge and practical recommendations for drivers;</li> </ul>	10 days	Association “BAMAP”, management of organizations, mechanics
2.2 Analysis of the technical condition of the vehicle fleet of a transport organization	Conducting an analysis of the technical condition of the vehicle fleet	<ul style="list-style-type: none"> <li>- checking the vehicles technical condition;</li> <li>- collecting fuel consumption data;</li> <li>- driving style analysis;</li> <li>- accident assessment;</li> </ul>	1 month	Management of transport organizations, technical services, mechanization department
2.3 Technical implementation and support of eco-driving	Optimization of vehicle operation	<ul style="list-style-type: none"> <li>- installation of monitoring systems (GPS);</li> <li>- control over compliance with eco-driving principles;</li> <li>- regular vehicles maintenance;</li> <li>- reporting automation;</li> <li>- driver incentive system development;</li> </ul>	3 months	Technical services, mechanization department, accounting
<b>3. Control and optimization</b>				
3.1 Performance monitoring	Analysis of results	<ul style="list-style-type: none"> <li>- monthly data collection and analysis;</li> <li>- eco-driving assessment;</li> </ul>	Monthly	Technical services,



		<ul style="list-style-type: none"> <li>- training correction (working on mistakes);</li> <li>- work on continuous improvement: updating regulations and key performance indicators for eco-driving;</li> </ul>		mechanization department, analytical department
3.2 Scaling up the eco-driving project	Expanding the eco-driving program	<ul style="list-style-type: none"> <li>- implementation in the country's transport organizations;</li> <li>- implementation in driving schools;</li> <li>- participation in eco-projects</li> </ul>	Constantly	Ministry of Transport and Communications of the Republic of Belarus, Association "BAMAP"

In order to visualize the presented roadmap, a Gantt chart was created (Figure 2).

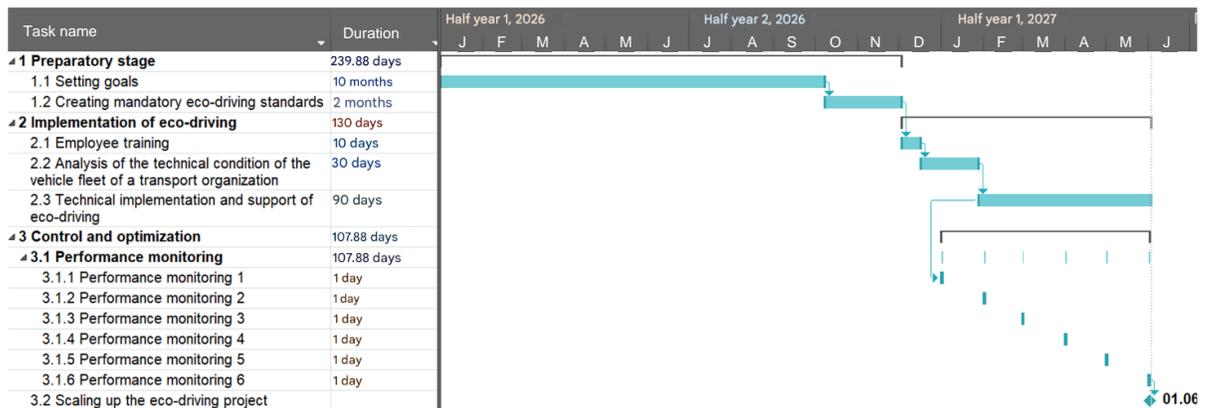


Figure 2. Gantt chart of the roadmap for the implementation of eco-driving in transport organizations of the Republic of Belarus

The key advantage of the roadmap is its comprehensive approach, which covers all aspects: from regulatory to technical implementation. It is a step-by-step, realistic and well-founded strategic plan for the implementation of eco-driving in transport organizations of the Republic of Belarus.

#### 4. Conclusion

Based on the conducted research, the following final provisions can be highlighted:

- approaches to defining the essence of the concept “eco-driving” are proposed; the author’s definition of “eco-driving” is clarified and scientifically substantiated from the point of view of sustainable transport within the framework of the green transition;
- based on a comparative analysis of literary sources, the basic principles of eco-driving as an element of sustainable transport are systematized;
- the business process “eco-driving” is proposed for implementation in the activities of transport organizations of the Republic of Belarus, using the example of Rising Ltd.: the proposed business process is described using a context diagram built in the IDEF0 notation; the choice of key criteria for assessing eco-driving is substantiated; a system for assessing eco-driving and driver motivation is created; savings from the introduction of eco-driving are calculated, which highlights its economic efficiency;

- for the practical implementation of the proposed solutions, a roadmap for the introduction of eco-driving has been developed, with visualization in the form of a Gantt chart, including specific stages, tasks and deadlines, which will allow scaling eco-driving at the level of the entire transport industry of the Republic of Belarus.

Authors consider the presented research to be a completed work containing new scientific and practical results in the field of eco-driving, which makes a significant contribution to the development of sustainable transport within the framework of the green transition.

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