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GREEN LOGISTICS AS AN OBJECT OF GREEN BUDGETING: THE EXAMPLE OF ELECTRIC VANS EXPLOIT INCENTIVISATION

Abstract. The article is devoted to the application of financial-managerial tools of green budgeting in public policy implementation to stimulate such climate oriented business activity as green logistics at the example of need to enlarge electric vans exploiting in Ukraine. The aim of this article is to propose the financial and managerial tool of green budgeting organization to stimulate startups of electric vehicles producing for the more environment friendly exploitation of the transport within green logistics implementation. Equations for the financial calculations of future compensation within green budgeting and motivating interest rate of the loans for the e-vans buyers with the dwindling resources of the budgets is developed. The methodology is based on the application of financial calculations for the modelling the equations of the loans interest paying by case method. The results of the article show the application of financial technology, by developing and proposing the stimulation tool within green budgeting, which could be used for incentivisation green logistic by start-up's client to obtain more environment friendly transportation in linkage to sustainable public policy. Results of the case modelling prove the economy for the electric van buyer when it exchange on the van with internal combustion engine, which could be the reason to buy the e-vehicle from start-ups. Sturt-ups are interested to improve the e-vans configuration. The scientific novelty refers to the conception of the green budgeting and green logistics linkage in their synergy for the implementation such green logistic base as environment friendly transport. Incentive Coefficient of budget compensation described and applying on the example of vehicles renewal in the green logistics. The practical value of the paper includes the algorithm of regulation in green public policy and propose the tools of benefit interests for target budget loans. Further research may be necessary to develop recommendations for the use of particular indicators of calculations in dynamics of the green logistics components development. This will allow reduce the costs from budgets on the green policy targets providing.

Keywords: public budgeting; green logistics; interest rate; green policy; electric vehicles; public finance management

Problem statement

Using of public budgets plays a decisive role in times of upheaval: like pandemics, wars, climate disasters and building of the new world management. Traditional practices of funding redistribution, political compromise and accountability are being transformed in response to emerging priorities. Green budgeting is a technology for serving the priority of preserving the environment within public policy implementation; it has recently been used in the list of responses to modern challenges for society.

Achieving of multiple goals through the budgeting is created a synergy to interaction of private business and public policy, as Kropelnytska and Mayorova shown on the example of renewable energy projects [1]. Green energy is one of the recognized priorities of green budgeting at the macro level [2]. It has been actively developing in Ukraine recent years, but budget expenditures on this policy are much less compared to nonrenewable resources in the energy sector [3]. The study of green logistics actively includes the use of electric transport. Thus, a stable relationship between green logistics and green budgeting began to form.

Green logistics is formed as a business response to risks: climatic and geopolitical. Russia's military actions against Ukraine showed the danger of countries' dependence on oil products. The overall coordination of

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participants actions in supply chains requires included in public policy financial support by public budgets and education of the economic agents about the climate neutral diversification in doing business.

Interaction between business and government is more likely through the scheme: introducing of the innovations from the business side and subsequent support of good practices through the public budgeting, as pointed Brandt at al [4]. An important consequence, that distinguishes green logistics, is the reduction of CO2 emissions. Therefore, we consider the prospect of public green policy in stimulating both the use of electric trucks (or e-vans) with an electric motor to provide green logistics, and start-ups for the production and modernization of such trucks.

A clear lack of theoretical knowledge and practice in matters of transportation according to the rules of green logistics, taking into account green budgeting, is observed today [5]. But the tasks of green tools are emergent in public policy. On the example of Ukraine, the general framework for development is defined in the National Economic Strategy for the period up to 2030, but in particular total greening of the economy and achieving climate neutrality no later than 2060.

Vehicles with gasoline and diesel engines have been used for various transportation for decades. Transportation by electric transport, which became more frequent 7-8 years ago, faced restrictions in populated areas [6]. These limitations have driven improvements in the performance of electric vehicles. Especially e-vans in logistics is preferable in urban areas or between nearby settlements. Transportation of cargo in cities is characterized by: frequent traffic stops, speed limits, noise limits, and restrictions on the release of pollutants into the air [7]. E-vans better meets these requirements.

Green budgeting tools are considered in primary assistance for stimulating a business entity to replace the truck with an internal combustion engine with an e-van. State support is offered in loans under the green budgeting toolkit for the purchase of e-vans from the producer start-up. Such loans will achieve two targets: firstly, they will ensure the start-up development without dependence of the search for an investor who wants to maximize profits [8]; secondly, they popularize green logistics transportation as one of the sustainable development goals components.

Literature review

The development of "green budgeting" began with a combination of financial and managerial tools [9]. Green budgeting is just one of the techniques of the "priority budgeting" approach to public budgeting [10, p.6], which in turn is based on performance-based budgeting type. As the OECD explains, green budgeting involves assessing the impact of budgetary and fiscal policies on the environment and assessing their consistency with the fulfillment of national and international obligations [5].

World studies on the "green logistics" organization proposed this term at the end of the last century. During the 1990s the concept of "green logistics" was formed which includes "transport services" along with the other components of logistics [11]. Murphy at al. gave one of the first definitions of "green logistics", where its difference is to minimize the harmful impact on the environment [12].

Grigorak summarized that "green" logistics is formed from a system of saving technologies and improved (or new) equipment throughout the supply chain in order to minimize the negative impact on the environment and increase the goods producer responsibility for the consumer [13].

Wu Hao at al. pointed that green logistics is considered as an important factor for the building sustainable economy of countries, especially those with a developed network, and therefore is considered as a contribution to the desired economic development [14]. Based on these conclusions, green logistic could be the target for public policy and the goal for public budgeting during the policy implementation. F. Diehlmann et al. noted that the collaboration between public and private sectors in the green logistics development can be beneficial for authorities and the public budgeting when supply chains need to be set up emergency [15] (during the war conflict, for example, or to reduce environmental footprint). Authors put “transport” as necessary component during all logistics process.

Yingfei at al. proposed the systematic "green logistics" framework which includes, in addition to the transport component, an application of infrastructure component [16]. These components determines the ability of subjects to

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green logistics and the quality of logistics services in order to have the best impact on the environment. Green logistic is the next stage after low carbon logistic and includes other “green” elements in the process [17]. E.D. de Souza et al. includes in green transportation the eco-friendly fuels and vehicle’s capacity to produce less footprint [18]. However, authors did not include e-vehicles in their calculation in particular.

Kumar pointed too that the features of "green logistics", although have other important components, mostly ensure the vehicle's safety [19]. Yes, vehicles should have less noise and emissions. The low carbon footprint of green logistics reduces resource renewal efforts and gives hope for a healthy life. The authors of previous publications emphasize that when using e-vans, the effect of reducing emissions into the atmosphere and the effect of relative fuel savings are achieved.

The aim of the article

The aim of this article is to propose the financial and managerial tool of green budgeting organization to stimulate byers of electric vehicles from startups for the more environment friendly transportation development within green logistics implementation. The statement of this article includes: a) confirmation of the successful commercialization of using in green logistics e-vans in comparison with comparable internal combustion engine vans, stated in previous years [7]; б) proposition of public support tools for start-ups with products of public importance concretization [8].

Results

Our previous research has shown that responsible start-up initiatives with uncertain profitability or no immediate profit attract outside investors less (for example in Ukraine) [8]. Therefore, the inculcation of electric vehicles should be ensured by appropriate public policy.

The qualitative and quantitative methods are included in research methodology. Qualitative methods were used to describe the conception of green budgeting and green logistic interaction, as well as to determine costs for the green budgeting. As a main qualitative approach case study methodology was used. The case study let us to provide an in-depth analysis of the problem in terms of combination of qualitative and quantitative characteristics of loans as green budgeting tool and green logistic applying. Quantitative method was applied to collect information on vehicle usage characteristics and modelling the formulas as the tools for further calculation.

We propose the concept of the interaction between green budgeting, green logistics and the use of developed by start-ups electric vehicles as shown in Figure 1.

Green budgeting provides the tools that organize budget spending in order to improve getting green policy targets [21]. Based on previous theoretical justifications, start-ups for the making of electric vehicles should be taken into account in the framework of the state’s green policy. The help of green budgeting for incentivising and standardizing e-vans exploitation can be carried out by two popular financial tools: a) subsidies from the budget (irrevocably) to manufacturers and / or users of the van, or b) issuing loans for the electric vans purchasing in order to increase their manufacturing and exploitation in the green logistic. Lending is a less heavy financial burden for the budget than the issuance of irrevocable subsidies. At the same time, we recommend organizing lending in cooperation with business, with determining the role of budget expenditures for the introduction of electric trucks in logistics as supports, rather than fully ensures the loan.

The stated public policy target should be the awareness by the owners and managers of logistics enterprises about the proven economic benefits of switching to electric vans [7]. As a result, they will made an investment decision on the purchase of new vehicles with a solution the dilemma "gasoline or electric van".

Let us substantiate the prospects of financial support for electric van manufacturers through green budgeting within the framework of the state policy. We pro-pose to involve the economy benefit and Incentive Coefficient into returning the interests by e-vans buyer. The Incentive Coefficient (IC) ranges from 0.01 to 1 and is applied to the amount of savings from operating an electric van compared to a gasoline van (or the other vehicle with an internal combustion engine).

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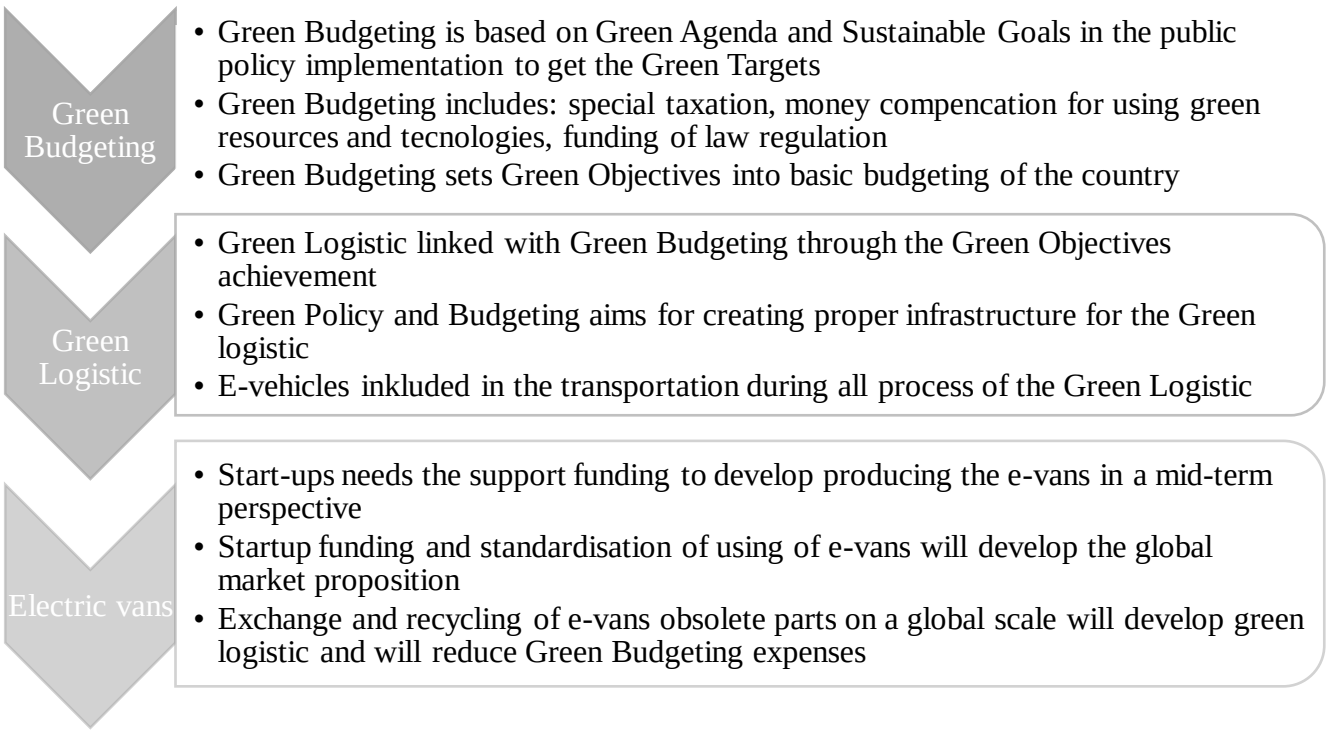

Source: Developed by authors based on [5, 20]

Fig. 1. Linkage between green budgeting, green logistic and electric vans exploitation

The amount of savings as a future benefit of the van owner is proposed as a determining factor for setting the loan interest rate in the framework of green budgeting. On this amount of savings, the van buyer can pay the interest himself and the value of the incentive coefficient will be equal to 0.01. A coefficient value of 1 means full compensation of interest rate for the buyer of the electric van, even taking into account future savings from its operation. The introduction of the Incentive coefficient will allow for a more flexible policy in compensating interest rate to buyers under green budgeting.

The proposed organization in the green budgeting support for the e-van users shown in Figure 2.

When circumstances allow using the market rate of commercial loans in the process of replacing gasoline vans with electric ones, it is proposed to compensate the difference between the calculated interests. Such compensation is based on the difference between the buyer's future savings and the current market cost of the loan interest for credit bodies. In this case, it is necessary to standardize the object of lending in order to prevent profit maximization by commercial lenders.

We model a case using a comparison of the quantitative parameters of the exploitation of two vans with gasoline and electric engines. For the case, the characteristics of the COOLON MOTORS e-van were applied, which, before the beginning of the Russian aggression, was at the stage of launch by the Ukrainian start-up CoolOn from Kryvyi Rih city. Made a comparison of this e-van with the modern van with an internal combustion engine from the Russian company GAZ (and the model range of GAZelle Next wirings). A comparison was made on the calculation based on the cost of exploiting the van with electric motor and the internal combustion engine for the same environment of the logistics transportation on the example of Ukraine with a mileage of 500,000 km.

On the example of comparison of COOLON MOTORS electric van and GAZell Next van, based on the internal combustion engine, the savings if the use of an electric van are confirmed. Next, we will use the Modified Internal Rate of Return (MIRR) formula as a basis [22] and transform it to calculate the approximate maximum rate for soft loans and a compensation from the public budget in case the purchasing of electric vans within the green budgeting framework.

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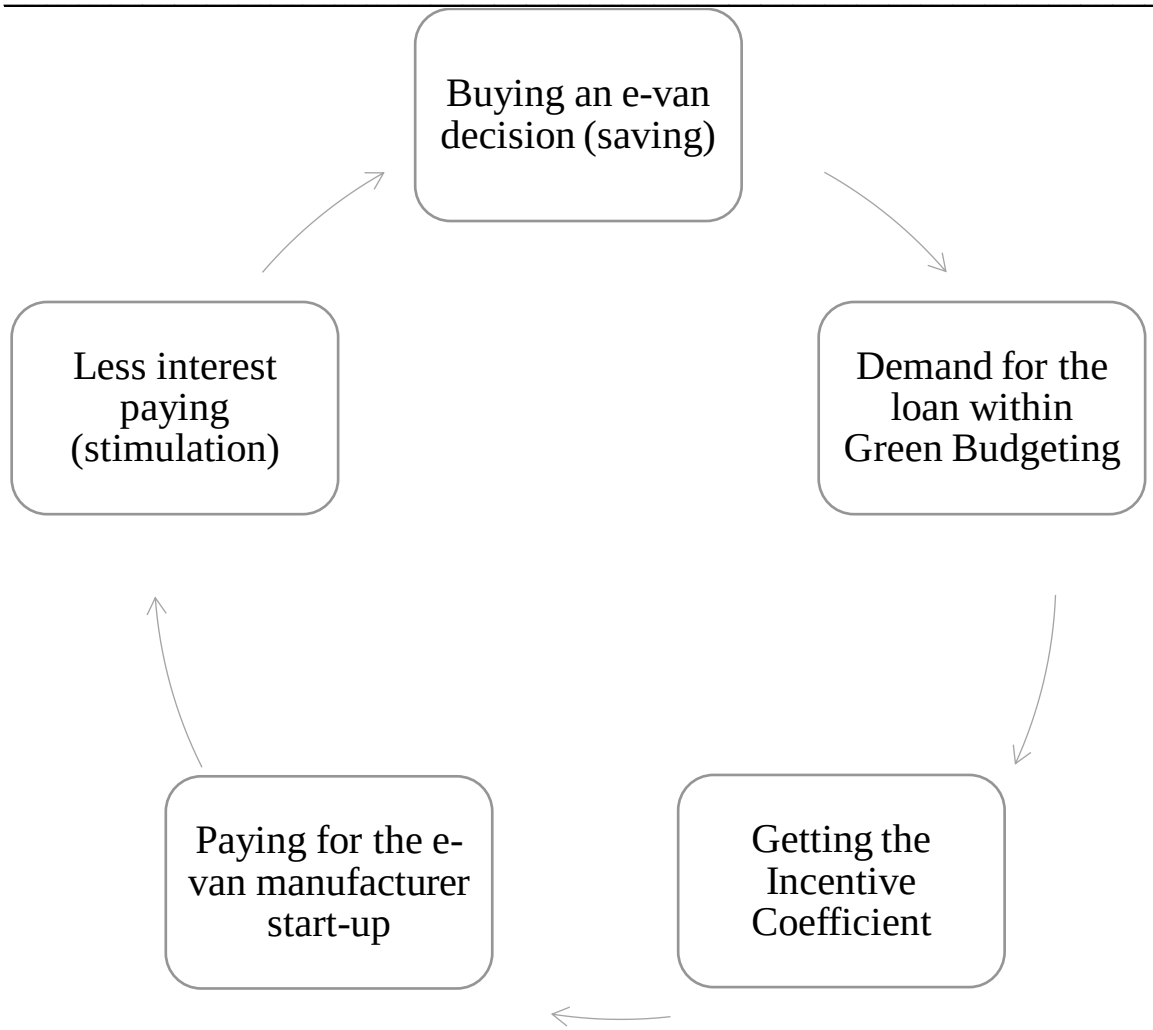

Source: Developed by authors

Fig. 2. Green Budgeting support organization for the manufacturers and buyers of the e-vans.

When calculating, we consider the organization of lending with public budgets expenses in the following way: through authorized credit bodies, participants in green logistics will receive loans for the purchase of e-vans with partial compensation of interest on them from the budget. At the same time, we propose to determine the sum of interest compensation based on no more than 50% from savings due to the further operation with the e-van, which corresponds to an Incentive coefficient meaning 0,5. Since the proposed Incentive Coefficient based on savings is simulated, we assume a parity of interests in the use of public finances and the development of entrepreneurship in the green logistics by leaving the logistic entrepreneur part of the savings from the exploitation of the vehicle. The revival of demand for e-vans will indirectly support start-ups in their production with the help of the same green budgeting.

The calculation of the economically motivating compensation from the budget for the purchase of the e-truck interest on the loan is modelled in Equation 1. It is based on an assessment of the reduced potential savings in operating costs during exploitation the electric van compared to a vehicle with an internal combustion engine (for the entire period of its exploitation), minus the cost of acquiring the e-van. Calculation of established previously Incentive Coefficient is applied.

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$$E = (EAC_2 - EAC_1 - PC) \times IC \quad (1)$$

where E – the sum of compensation from the budget for interest on a targeted loan for the purchase of an e-van;

EAC_1, EAC_2 – equivalent costs for exploitation the van with an internal combustion engine and electric engine for the van, respectively. Calculated as the current rate of annuity payments with a simulated discount rate of 14% based on the average [23] with additional risk for 2021 in Ukraine;

PC – the cost of buying an e-van at the current price;

IC – Incentive Coefficient, which can change based on the fiscal capacity of the budget and decisions of the state green policy. For the calculation in this simulation, it is taken equal to IC=0.5, which ensures the parity of interests of the e-van buyer and the state authority policy (the amount of potential savings of the buyer is distributed equally between them - 50:50).

Next, we propose to calculate the recommended (motivating preferential) rate for the lending to green logistics initiatives within the framework of green budgeting according to Equation 2

$$R = {}^{E_n}/_{PC} \times 100 \quad (2)$$

where R is the recommended (motivating) interest rate on the loan which will be compensate from the public budget;

En – yearly amount of compensation from the budget for interest on a targeted loan for the purchase of an e-van. This sum equal to the yearly amount of potential savings on the operating costs of an electric van compared to a gasoline analogue, minus the van's purchase costs and with Incentive Coefficient applying. En calculated by divided the previously modelled in formula 1 compensation E on number of the years of vans exploitation. In our case, the years number of the vans exploitation is 10;

PC – the current market price of the e-van (acquisition price).

Comparative calculation data within the frame of case modelling composed in Table 1.

Proposed modelling in case for calculating the amount of compensation payments and a reasonable recommended interest rate for a loan suggest that in order to receive a loan the buyer must comply with the requirements for the e-van characteristics in order to ensure the necessary environmental friendliness of its using. The process of issuing such green budgeting loans should be subject to the standard procedures and rules of the authorities supervision on the lending services calculation of rates, which should counteracting the desire of credit bodies to maximize their profits through compensation from the budget.

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Table 1.

Operating performance of diesel and electric vans with similar characteristics.

Source: developed by authors based on [23, 24, 25]

Indicator	Unit of measurement	Commercial van	
		GAZelle Next (1) (diesel engine)	COOLON MOTORS (2) (electric engine)
Manufacturer	Country of producing	Russia	Ukraine
Price (Purchasing expenses)	UAH	400 000	433 500
Price of fuel (UAH per liter or UAH per kWh)	UAH	30	1,68
Fuel costs per year	UAH	**135 000**	**22 000**
Costs per year for engine maintenance	UAH	10 000	1 000
The total cost of technical reviews and repairs per year	UAH	20 000	7 500
Present value of depreciation charges	UAH	20 864	22 612
Equivalent annual costs, EAC	UAH	185 864,46	53 111,86
The cost of transportation per 1 km	UAH	3,72	1,06
Compensation E of interest on credit (with an Incentive Coefficient meaning 0.5)	*UAH*	-	*447013*
Reasonable recommended (motivating) interest rate for a loan which compensated from the budget	*%*	-	*10,3*

Conclusions

Proven economic efficiency of the e-van exploitation compared to van with the internal combustion engine let the possibility to propose the tools of green budgeting. Future savings of business during the e-vans exploitation in logistics could be the source for returning of funding help through public budgets to force green public policy targets. And these help could be a loan tool, which established in participation of the private and public bodies.

The proposed form of the loan on electric van provides the purchasing capacity of a business in relation to e-vans producers. Start-ups that develops, improves and manufacture ergonomic models of electric vans gets support for their development. Due to the future benefit, the buyer repays the body of the loan, and the interest on it can be fully or partially repaid by the authorities as a part of the implementation of green policy to accelerate the development of the electric van market. This tool for regulating the demand for electric vans involves flexible compensation from the budget, for which the Incentive Coefficient is proposed. Compensation funding tool should create the incentivisation for e-vans market and gradually cease later.

The controversial point of the study is the difference between the discount rate, electricity prices, production costs of the e-vehicles in different countries. Therefore, the proposed in the article framework of indicators and equations requires specification in each practical case of calculating the green budgeting costs for green logistics.

The prospect of further research is to formulate a closer and performance connection between the implementation of a sustainable state policy on a neutral and positive impact on the environment, green logistics and green budgeting tools.

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ЗЕЛЕНА ЛОГІСТИКА ЯК ОБ'ЄКТ ЗЕЛЕНОГО БЮДЖЕТУВАННЯ: НА ПРИКЛАДІ СТИМУЛЮВАННЯ ВИКОРИСТАННЯ ЕЛЕКТРОВАНТАЖІВОК

Abstract. Стаття присвячена застосуванню фінансово-управлінських інструментів зеленого бюджетування в реалізації державної політики для стимулювання такої кліматично орієнтованої ділової активності, як зелена логістика, на прикладі необхідності збільшення експлуатації електрофургонів в Україні. Метою цієї статті є запропонувати фінансово-управлінський інструмент організації зеленого бюджетування для стимулювання запуску виробництва електромобілів для більш екологічної експлуатації транспорту в рамках впровадження зеленої логістики. Розроблено рівняння для фінансових розрахунків майбутньої компенсації в рамках зеленого бюджетування та мотиваційної відсоткової ставки за кредитами для покупців електронних фургонів із скороченням ресурсів бюджетів. Методологія заснована на застосуванні фінансових розрахунків для моделювання рівнянь виплати відсотків за кредитами за методом випадку. Результати статті показують застосування фінансових технологій шляхом розробки та пропонування інструменту стимулювання в рамках зеленого бюджетування, який може бути використаний для стимулювання зеленої логістики клієнтом стартапу для отримання більш екологічно чистих транспортних засобів у зв'язку зі стійкою державною політикою. Результати моделювання кейсів доводять економічність для покупця електрофургона при його обміні на фургон з двигуном внутрішнього згоряння, що може стати причиною покупки електронного транспортного засобу у початківців. Стартапи зацікавлені в покращенні конфігурації електронних фургонів. Наукова новизна стосується концепції зв'язку зеленого бюджетування та зеленої логістики в їх синергії для впровадження такої зеленої логістичної бази, як екологічно чистий транспорт. Коефіцієнт стимулювання бюджетного відшкодування описано та застосовано на прикладі оновлення транспортних засобів в зеленій логістиці. Практична цінність роботи включає алгоритм регулювання зеленої державної політики та запропоновано інструменти пільг за цільовими бюджетними кредитами. Для розробки рекомендацій щодо використання окремих показників розрахунків у динаміці розвитку компонентів зеленої логістики можуть знадобитися подальші дослідження. Це дозволить зменшити витрати з бюджетів на забезпечення цілей зеленої політики.

Keywords: публічне бюджетування; зелена логістика; процентна ставка; зелена політика; електромобілі; управління публічними фінансами

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