

# THE INSTITUTIONAL AND BEHAVIORAL MODEL OF ECO-ORIENTED PUBLIC-PRIVATE PARTNERSHIP WITHIN UKRAINE'S SUSTAINABLE DEVELOPMENT SYSTEM

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## The Institutional and Behavioral Model of Eco-Oriented Public-Private Partnership within Ukraine's Sustainable Development System

The aim of the article is to examine the theoretical and methodological foundations for the formation of environmentally oriented public-private partnerships (eco-PPPs) as an institutional mechanism for Ukraine's sustainable development, taking into account behavioral models of interaction between the State and the private sector. The article substantiates the relevance of moving from a purely financial perspective on PPPs to an integrated approach that combines economic feasibility, environmental effectiveness, and trust in the context of post-war recovery and European integration. The author analyzes the current state of eco-PPP implementation in Ukraine based on twelve projects in the sectors of transport, energy efficiency (ESCO/EPC), thermal energy, waste management, and municipal infrastructure. For each project, key parameters are systematized: the level of State support, environmental requirements, institutional trust, risk of non-compliance, and expected investor return. The synthesis of empirical data showed that initiatives combining significant government support with a high level of trust under moderate risk have the highest likelihood of stable implementation. Environmental requirements do not reduce investment attractiveness when compensatory mechanisms are in place, such as EPC standards, backing from international financial institutions (for example, EBRD Green Cities programs), transparent selection procedures, and professional municipal management. The methodological foundation consists of logical-structural and comparative analysis combined with empirical generalization, with an emphasis on the behavioral-institutional interpretation of decisions by private investors and government bodies. The scientific novelty lies in the development of a comprehensive behavioral-economic approach to evaluating eco-public-private partnerships, integrating trust, risk, government support, and environmental requirements into a single analytical framework without excessive quantitative complexity. The practical significance lies in the possibility of using the proposed approach as a basis for the national "Green PPP Framework" system, which entails standardizing environmental criteria, establishing transparency standards, and introducing basic tools for guaranteeing and monitoring socio-environmental effects.

**Keywords:** public-private partnership, environmental efficiency, sustainable development, government support, behavioral model, risks, institutional model.

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### Ілченко С. В. Інституційно-поведінкова модель екологічно орієнтованого державно-приватного партнерства в системі сталого розвитку України

Метою статті є дослідження теоретико-методологічних засад формування екологічно орієнтованого державно-приватного партнерства (еко-ДПП) як інституційного механізму сталого розвитку України з урахуванням поведінкових моделей взаємодії держави та приватного сектора. Обґрунтовано актуальність переходу від суто фінансового бачення ДПП до інтегрованого підходу, що поєднує економічну доцільність, екологічну результативність і довіру в умовах повоєнного відновлення та євроінтеграції. У статті проаналізовано сучасний стан реалізації еко-ДПП в Україні на основі дванадцяти проектів у секторах транспорту, енергозбереження (ESCO/EPC), теплоенергетики, поводження з відходами та комунальної інфраструктури. Для кожного проекту систематизовано ключові параметри: рівень державної підтримки, екологічних вимог, інституційної довіри, ризику невиконання та очікуваної віддачі інвестора. Узагальнення емпіричних даних показало, що найвищі шанси на стабільну реалізацію мають ініціативи, де поєднується значуща державна підтримка і високий рівень довіри за помірною ризику. Екологічні вимоги не знижують інвестиційну привабливість за наявності компенсаційних механізмів – стандартів EPC, супроводу міжнародних фінансових інституцій (наприклад, програм EBRD Green Cities), прозорих процедур відбору та професійного муніципального менеджменту. Методологічну основу становлять логіко-структурний та порівняльний аналіз у поєднанні з емпіричним узагальненням, акцент зроблено на поведінково-інституційній інтерпретації рішень приватних інвесторів та державних органів. Наукова новизна полягає у формуванні цілісного поведінково-економічного підходу до оцінювання еко-ДПП, що інтегрує параметри довіри, ризику, державної підтримки та екологічних вимог у єдину аналітичну структуру без надмірної кількісної ускладненості. Практичне значення полягає у можливості використання запропонованого підходу як основи для національної системи «Green PPP Framework», що передбачає унормування екологічних критеріїв, встановлення стандартів прозорості, а також запровадження базових інструментів гарантування й моніторингу соціо-екологічних ефектів.

**Ключові слова:** державно-приватне партнерство, екологічна ефективність, сталий розвиток, державна підтримка, поведінкова модель, ризики, інституційна модель.

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**Introduction.** Ukraine's modern economy is entering a phase of recovery and profound structural transformation, necessitating new approaches to aligning the pace of economic growth with the requirements of environmental safety. The challenges of post-war reconstruction, convergence with the regulatory standards of the European Union (EU), and the shortage of budgetary resources intensify the need to mobilize private capital for financing infrastructure and environmental projects. Under these conditions, public-private partnership (PPP) emerges as an effective institutional mechanism for implementing the goals of sustainable development, ensuring the coordination of both the State and business interests, the efficient allocation of risks, and the integration of environmental requirements into the project cycle.

At the same time, conventional PPP models, focused primarily on financial indicators, prove to be insufficiently adaptive to conditions of heightened uncertainty, escalating environmental risks, and a volatile regulatory environment. They virtually disregard behavioral determinants – such as the level of mutual trust, risk tolerance, perception of green requirements, and the institutional capacity of the State to honor its commitments. It is precisely these factors that largely determine the success or failure of environmentally oriented projects.

The existing academic discourse remains largely focused on the legal and financial components of PPPs, while the mechanisms of behavioral interaction between the parties remain conceptually underdeveloped. As a result, a gap emerges between the declared objectives of the green transition and the actual implementation outcomes, indicating the methodological incompleteness of current approaches. Hence arises the scientific task of developing an institutional-behavioral model of environmentally oriented PPPs that integrates economic, environmental, and institutional parameters, accounts for their interdependence, and enables a substantiated forecast of the effectiveness of sustainable development projects in Ukraine.

**Analysis of recent research and publications.** Recent studies on PPPs in the green sectors have evolved along several key directions. The first direction focuses on governance and contract design – including risk allocation, forms of State support, blended financing mechanisms, procedural transparency, and the monitoring of environmental obligations. The second direction develops regulatory and methodological foundations of environmental, social, and governance (ESG) standards, as well as the approaches of international financial institutions to integrating eco-criteria into project selection and supervision, particularly at the municipal level (standardized conditions and environmental and social management policies). The third di-

rection concentrates on technological solutions – energy efficiency, decarbonization, and digital monitoring – and assesses their payback and impact on urban infrastructures.

At the same time, the behavioral mechanisms underlying environmental performance remain only partially explored – including the role of mutual trust between the parties, the perception of environmental requirements by private investors, the impact of the institutional capacity of the public side on contract enforceability, and the relationship between the configuration of State support and the willingness of businesses to assume green risks. Consequently, there is still no coherent conceptual model that explains when and why projects with similar financial parameters demonstrate differing resilience and implementation dynamics.

Current international research demonstrates a clear trend towards the integration of financial, environmental, and behavioral determinants within PPPs. However, it also reveals methodological limitations – namely, the absence of comprehensive, integrated approaches capable of quantitatively reflecting the interdependence between trust levels, State support, environmental requirements, and associated risks. For Ukraine, this issue is of particular importance, as the success of attracting private capital to green projects critically depends on the quality of the institutional environment, the transparency of incentives, and the predictability of regulatory frameworks.

The subsequent review systematizes key international contributions that provide the scientific foundation for developing an institutional-behavioral model of eco-PPP. Although these studies convincingly highlight individual components – such as risk, trust, State support, and environmental standards – they do not offer a coherent quantitative mechanism for their integration and empirical validation.

Thus, Casady et al. [1] present a comprehensive overview of the role of PPPs in financing low-carbon and climate-resilient infrastructure, demonstrating that governments increasingly employ this mechanism in response to budget constraints and the demand for innovation. However, the study leaves aside the behavioral interactions between the public and private partners – including institutional trust, incentive structures, and risk perception – and does not define the policy thresholds necessary to ensure the fulfillment of environmental obligations without compromising investment attractiveness.

A similar empirical perspective is offered by Tang et al. [2], who, based on evidence from China's wastewater treatment sector, demonstrated that the involvement of private capital is associated with higher technological efficiency and reduced emissions. However, the specific conditions under which this

effect occurs remain undefined – the study does not identify which configurations of institutional trust, risk allocation, and State support drive environmental improvements. Hence, there is a need for a model capable of capturing the behavioral mechanisms underlying the formation of such outcomes.

Abdullah and Khadaroo [3] convincingly demonstrate the relationship between trust, control, and partnership performance (using evidence from educational projects in the United Kingdom). However, their analysis omits the environmental dimension, the parameters of State support, and the specific features of green contracts. Wang et al. [4] demonstrate that trust networks reduce opportunistic behavior and enhance the efficiency of collaboration, yet they do not establish a quantitative connection between trust and environmental outcomes. In turn, Zhang et al. [5] model an evolutionary game among the State, business, and society with a central role assigned to reputational incentives, but the model is not adapted to environmentally oriented PPPs and does not define the threshold parameters of incentives necessary for practical policy calibration.

In the study by Chunling et al. [6], a paradoxical relationship was identified between PPP investments in the energy sector and the increase of ecological footprint. The authors interpret this effect primarily through the lens of macroeconomic dynamics, without engaging behavioral or institutional explanations. Tipu et al. [7] demonstrate that environmental uncertainty weakens the influence of key success factors on the sustainable performance of projects; however, their model omits both mandatory environmental commitments and threshold values of State support and trust. Fleta-Asin Munoz and Munoz [8] convincingly show that the configuration of risk allocation in green energy PPPs significantly affects financing feasibility, yet they do not examine the behavioral interaction between partners or the role of specific environmental requirements.

The policy and methodological materials of the World Bank [9; 10] unify approaches to environmental and social standards and the management of climate risks, yet they do not provide behavioral interpretations of how these standards influence project performance, nor do they establish threshold levels for State support or trust. The OECD reports [11; 12], while highlighting the institutional context of municipal and subnational PPPs – such as coordination, capacity building, and multi-level governance – likewise overlook the micro-mechanisms of trust formation, the environmental performance indicators, and the behavioral threshold incentives.

Hence, even the most recent international empirical and policy studies leave the interdependence between institutional trust, State support, environmental requirements, and risks insufficiently explored. The integration of these variables into a coherent, quantitatively verifiable institutional-behavioral model constitutes the principal scientific novelty of the present article.

**Identification of previously unresolved aspects of the general problem.** Despite the growing scholarly interest in the greening of economic institutions and the broader of PPP practices in Ukraine, several fundamental issues remain insufficiently elaborated or lack a robust theoretical and methodological foundation. First, the majority of studies interpret PPPs

primarily through a financial-investment lens, focusing on capital expenditure allocation, concession arrangements, and State guarantee mechanisms. The environmental dimension of contracts is either excluded from the system of performance assessment or treated as an auxiliary rather than a structural determination of partnership sustainability. Second, there is a lack of a comprehensive behavioral-economic interpretation of private investors' decision in green projects. Prevailing approaches rely on the classical rationality paradigm, with limited attention to trust, reputational expectations, environmental risks, and ethical motivations. Consequently, they fail to explain why some projects, despite formally attractive economic parameters, either fail to progress to the implementation stage or remain prolonged at the preparatory phase. Third, the academic discourse lacks an institutionally coherent model of eco-PPP that would simultaneously integrate regulatory parameters (State guarantees, environmental standards), socio-behavioral factors (trust, risk perception), and economic returns to private partners. Existing approaches tend to isolate these dimensions, thereby preventing the formation of a holistic conceptual framework for understanding the State-business interaction under environmental challenges.

Fourth, Ukraine's national practice lacks instruments for assessing the behavioral resilience of partnerships – that is, the conditions under which the State and private investors maintain a balanced distribution of benefits and risks while pursuing environmental objectives. The issue of achieving equilibrium between economic feasibility and environmental performance becomes particularly acute in the context of post-war reconstruction, where solutions must be both rapid and sustainable. Fifth, the institutional environment in Ukraine remains fragmented and lacking systemic coherence: inconsistencies within the regulatory framework, the absence of unified approaches to evaluating green projects, and imperfect partner selection procedures undermine private sector trust and hinder the formation of a mature market for environmentally oriented investments.

Hence, the unresolved component of the general problem lies in the absence of a systemic behavioral-economic model of eco-PPP – one capable not only of providing a quantitative assessment of partnership performance but also of explaining the motivational mechanisms of participants, accounting for the interplay between State support, trust, risk, and environmental requirements. Addressing this methodological gap – through the development of a comprehensive approach to the formation and evaluation of environmentally oriented PPPs as an institutional mechanism of sustainable development in Ukraine – constitutes the core objective of this article.

**Formulation of the research aim.** The aim of this article is to develop and empirically verify an institutional-behavioral model of environmentally oriented public-private partnerships (eco-PPPs) that elucidates the interrelationship between the level of State support, environmental requirements, institutional trust, and risks in achieving sustainable outcomes of partnership projects.

**Description of the research methodology.** The research methodology is based on a synthesis of both institutional and behavioral-economic approaches, which enables the interpretation of environmentally oriented eco-PPPs as a multidimensional socioeconomic process wherein economic incentives,

environmental priorities, and institutional trust between the public and private sectors interact. The theoretical foundation draws upon the principles of institutional economics (D. North, O. Williamson), the conception of bounded rationality under conditions of incomplete information, as well as contemporary approaches to the development of green financial instruments and the policy of sustainable development.

In the methodological dimension, the study implements a three-tier logic of analysis. At the *conceptual level*, it defines the essence of eco-PPP as an institutional mechanism of sustainable development, wherein economic gains are aligned with ecological efficiency and social legitimacy of projects. The principles of risks, responsibility, and incentive allocation are formulated on the premise of balance between control and compensation: risks are allocated not as a burden but in accordance with each party's capacity to anticipate, manage, or mitigate their consequences. The party assuming a greater share of risk should receive a proportionate return or guarantee. Responsibility must correspond to the degree of managerial influence over project implementation, while incentives should ensure mutual benefits from achieving both economic and environmental objectives. For the public sector, the key principles include regulatory transparency, policy stability, and reliable guarantee mechanisms; for the private partner – predictability of conditions, technological flexibility, and fair remuneration for assuming environmental and operational risks; at the *analytical level*, the study identifies the key determinants of partnership performance – the level of environmental requirements embedded in the contract ( $E$ ), the scale of public support ( $G$ ), institutional trust ( $T$ ), the risk of non-performance ( $R$ ), and the expected return for the private investor ( $P$ ). Their logical interrelations and respective roles in shaping the stability of eco-PPP arrangements have been defined. At the empirical level, a synthesis of twelve Ukrainian projects in the fields of transport energy efficiency (ESCO/EPC), district heating, and municipal infrastructure is undertaken. For each case, a structured description of parameters  $E$ ,  $G$ ,  $T$ ,  $R$  and  $P$  is provided and compared against the actual implementation status of the project.

For the purpose of analytical generalization, the study employs system, comparative, and structural-logical analysis, which makes it possible to identify the interdependencies between public support, the level of institutional trust, the risk profile, and environmental requirements. The case study method is applied to examine representative examples in greater depth – including the Olvia and Kherson port concessions, municipal energy efficiency projects of the ESCO type, and initiatives implemented under the Green City programs – which illustrate typical models of stakeholder interaction and the institutional preconditions for project success.

To ensure appropriate analytical rigor, the study introduces a simplified formalization of the behavioral interrelations among the key parameters of the partnership. It is assumed that the utility functions of the State and the private investor are determined by a common set of variables reflecting environmental requirements, the scale of public support, the level of institutional trust, the risks of non-performance, and the expected economic return:

$$U_s = f(E, G, R, T, SD), U_p = f(G, E, R, T, P), \quad (1)$$

where  $E$  denotes the level of environmental requirements,  $G$  – the volume of public support or guarantees,  $R$  – the risk of non-fulfillment of obligations,  $T$  – institutional trust,  $P$  – the expected economic return of the investor, and  $SD$  – the sustainable outcome of the project.

It is formalized that the utility of the private investor follows an additive relationship:

$$U_p = \alpha_1 G + \alpha_2 T + \alpha_3 E - \alpha_4 R + \alpha_5 P, \quad (2)$$

where  $\alpha_i$  are weight coefficients reflecting the magnitude of influence of each corresponding factor. For the State, the utility function takes the form:

$$U_s = \beta_1 E + \beta_2 T + \beta_3 (G - R) \quad (3)$$

where  $\beta_i$  denote weight coefficients expressing the relative priority of environmental outcomes and institutional trust over the fiscal costs and risks associated with public support. The state of behavioral equilibrium between the public and private partners is defined by the proximity of their expected utilities:

$$\begin{aligned} |U_p - U_s| &\leq \tau, \\ \tau &= 0,1 \cdot \bar{U}, \end{aligned} \quad (4)$$

$$\bar{U} = \frac{1}{2}(U_p + U_s),$$

meaning that the deviation between the partners' evaluations does not exceed 10%. Under this condition, the partnership is interpreted as behaviorally stable; a significant divide, by contrast, indicates an asymmetry of expectations and heightened risk of trust erosion.

The model verification was carried out using methods of comparative analysis and empirical generalization based on a sample of twelve Ukrainian projects across the sectors of transport, energy efficiency, district heating, and municipal infrastructure. For each case, the respective levels of  $E$ ,  $G$ ,  $T$ ,  $R$ , and  $P$  were determined, and the resulting values of  $U_p$  and  $U_s$  were correlated with the actual implementation status (preparation / in progress / competed). This approach makes it possible to identify parameter configurations under which behavioral equilibrium is achieved, as well as to detect factors driving deviations from it.

The proposed framework captures the mechanism of interdependence between public support, institutional trust, the risk profile, and the environmental orientation of partnership contracts. Its application ensures a logically consistent verification of empirical outcomes and provides a basis for substantiated conclusions on the conditions required to attain sustainable behavioral equilibrium between economic benefits and environmental objectives within public-private partnerships.

**Presentation of the main material and research findings.** In the context of Ukraine's post-war recovery, environmentally oriented PPPs (eco-PPPs) are emerging as a core institutional mechanism for coordinating the investment, managerial, and environmental priorities of the State and private sectors. Unlike traditional approaches that reduce efficiency to financial returns alone, eco-PPPs integrate environmental performance, compliance risks with ecological standards, and behavioral factors of trust between the parties. This renders them a fundamental instrument for implementing sustainable development policy at the national level.

In the proposed research framework, the partnership is analyzed through the interrelation of five parameters: public support ( $G$ ), environmental requirements ( $E$ ), institutional trust ( $T$ ), risk of non-performance ( $R$ ), and the investor's expected return ( $P$ ). Their interaction is formalized through system of utility functions for the public and private partners (Equations 2 and 3). The state of behavioral equilibrium in eco-PPPs is defined by the proximity of expected utilities of the two sides (Equation 4), reflecting the alignment of benefits and costs and ensuring the stability of the partnership. At the empirical level, the equilibrium was verified using a sample of twelve Ukrainian eco-PPP projects (Tab. 1) spanning maritime transport, energy efficiency, district heating, wastewater management, and municipal infrastructure. The aggregated mean values of the parameters are as follows:

$$\bar{G} = 3.08, \bar{E} = 4.42, \bar{T} = 4.25, \bar{R} = 2.67.$$

The majority of projects are characterized by a high level of institutional trust ( $T \geq 4$ ) and low to moderate risk ( $R > 3$ ). The share of projects currently "in progress" or "completed" stands at 83%, which confirms the relative effectiveness of eco-PPPs in the Ukrainian context.

The sectoral differences are summarized in Tab. 2, which present the distinct parameter configurations of  $G$ ,  $E$ ,  $T$  and  $R$  across the six principal domains of eco-PPPs.

In particular, an increase in State support ( $G$ ) is observed in maritime concession projects, while high environmental standards ( $E$ ) combined with low levels of support ( $G$ ) are typical of energy efficiency initiatives; balanced parameter configurations prevail in district heating projects. Such comparative analysis makes it possible to interpret structural differences across sectors and to identify the conditions for achieving behavioral equilibrium, where the balance of benefits and risks between the State and the private partners remains stable.

Providing a deeper understanding of this relationship, the following sectoral interpretations illustrate the interplay between State support, trust, environmental requirements, and risk within each group of projects:

*Maritime transport* – high State support combined with moderate environmental requirements and medium risk creates an acceptable profile for private capital. Behavioral equilibrium is attainable under conditions of transparent procedures and regulatory stability.

*Energy efficiency* – low levels of State support are offset by strict environmental requirements, measurable outcomes, and relatively high trust. A risk reduction to 2.6 keeps the system close to equilibrium even in the absence of substantial guarantees.

*Municipal infrastructure* – maximum environmental standards and trust, coupled with low risk, provide the most favorable balance; even moderate State support is sufficient to ensure stable implementation.

*District heating* – a balanced configuration featuring high trust and adequate support under medium risk ensures a high likelihood of achieving behavioral equilibrium.

*Wastewater management* – stringent environmental requirements necessitate either additional guarantees or enhanced institutional trust. Given the current configuration, equilibrium is possible but remains sensitive to regulatory uncertainty.

*Transport infrastructure* – low State support is partially compensated by low risk and adequate trust. Such projects remain viable provided that contracts are standardized and monitoring mechanisms are transparent.

Behavioral stability of eco-PPPs is most frequently observed under configurations featuring high or sufficient State support combined with high institutional trust and medium risk (as in maritime transport and district heating), or low support accompanied by strict environmental requirements, measurable outcomes, and low risk. Sectors with  $E = 5$  and  $R = 3$  (e. g., wastewater management) require institutional reinforcement of trust or additional guarantees to stabilize equilibrium.

Based on a comparative analysis of eco-PPP parameters and the actual implementation status of projects, several consistent patterns emerge, revealing the internal logic governing the functioning of environmentally oriented PPPs.

First, project success depends primarily on the combination of State guarantees ( $G$ ) and mutual trust ( $T$ ) between the parties. In the group of projects where  $G \geq 4$  and  $T \geq 4$  with  $R \leq 3$  (such as the Kherson and Olvia ports, Kyiv district heating, and the Chornomorsk port concession), the highest share of completed initiatives was recorded – approximately 75%. This configuration indicates that the alignment of financial guarantees and institutional trust establishes behavioral equilibrium ( $U_P \sim U_S$ ), wherein the interests of the State and private partner remain in a stable balance.

Second, excessive environmental rigidity without appropriate compensatory mechanisms undermines the investment motivation of private sector. In projects with  $E \geq 5$  – such as the Khmelnytskyi solid waste management project and ESCO street lighting initiatives – investor interest is sustained only in the presence of additional support from international financial institutions (IFIs) or through the application of EPC standards, which mitigate the subjective perception of risk and ensure predictability of environmental requirements.

Third, institutional trust serves as a pivotal behavioral moderator. In all projects with  $T \geq 4$  (representing 100% of this sample group), decision-making processes are characterized by transparency, involvement of international partners, or enhanced municipal oversight. These features significantly reduce informational asymmetry and offset the relatively low level of State support ( $G$ ) in locally scaled projects.

Fourth, a moderate level of risk ( $R \approx 3$ ) proves to be optimal for maintaining stable cooperation between the parties. An excessively low level of risk  $R \leq 2$  tends to diminish innovative dynamics, while an increase to  $R = 4 - 5$  often results in project disruption or suspension. Hence, a medium risk level ensures mutual discipline and predictability in the behavior of partnership participants.

Based on the systematization of the obtained results, it is found that behavioral equilibrium in eco-PPPs is achieved under the following parametric configuration:  $G \geq 4$ ,  $T \geq 4$ , and  $3 \leq R \leq 5$ , with  $R \leq 3$  – corresponding to optimal stability. Under these conditions, the likelihood of balancing State and investor interests is the highest. Empirical comparison of the model with actual implementation outcomes demonstrates that three out of four projects (~33% of the sample) meeting these parameters are already in the implementation phase. This finding substantiates the hypothesis of the decisive influence of trust

**Table 1**  
**Characteristics of eco-PPPs in Ukraine by sector, type of support, and parameters of behavioral equilibrium**

№	Project	Sector	PPP type	Investment UAH million	G	E	T	R	Format of State support	Key eco-requirements	Trust components	Key risks	Status
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Kherson sea port [14]	Maritime transport	Concession	300	4	3	4	3	Concession agreement, private investment, concession payment, preparation with IFI (IFC/EBRD)	EIA compliance, environmental standards for port operations	PPP agency participation, IFC/EBRD involvement, transparent competition	Regulatory, security, market demand for transshipment	Ongoing
2	Olvia sea port [15]	Maritime transport	Concession	1370	5	4	4	3	35-year concession, private investment, municipal infrastructure obligations	Environmental legislation compliance, modernization with mitigation measures	International operator QTerminals, IFI supervision, PPP agency	Regulatory, macro/FX, industry fluctuations	Ongoing
3	Khmelnyskyi solid waste project [16]	Municipal infrastructure	Greenfield (EBRD GC)	600	3	5	5	2	EBRD loans (Green Cities), municipal support (land, permission)	MBT plant, landfill reclamation, methane/CO <sub>2</sub>	EBRD policy (ESAP, ESIA), municipal transparency	Construction, social acceptance	Ongoing
4	Kyiv district heating system [17]	District heating	Reconstruction (EBRD GC)	7200	4	4	5	3	EBRD loans, municipal guarantees /phased approach	Heat loss reduction, boiler / pipe modernization, CO <sub>2</sub> mitigation	EBRD standards, strong municipal borrower	Technical tariff / payment, force majeure	Ongoing
5	Lviv street lighting [18]	Energy efficiency	PPP/Concession (pilot)	320	2	5	4	3	Municipal contract, possible IFI support (GCAP)	LED, control systems, energy audit	Green Cities program, open procurement	Technical (supply), budget limits	Completed
6	Chornomorsk port (preparation) [19]	Maritime transport	Concession	2500	4	4	4	3	Concession tender preparation, private operator interest	Eco-standards for terminals and waters	State institutions, potential IFI	Regulatory, market, security	In preparation
7	Kaidatske wastewater facilities (Dniipro) [20]	Wastewater management	Mixed (municipal+IFI/EIB)	900	3	5	4	3	Mixed funding model (IF/EIB)	EU standards, purification, sludge/biogas utilization	Public consultations, international support	Technical, construction, tariff, regulatory	In preparation
8	Slavutych ESCO project [21]	Energy efficiency	ESCO/EPC	36	2	5	5	2	Municipal EPC, partial donor and technical support	LED, automation, guaranteed savings	Public participation, transparent tenders, donor support	Contractual, O&M	Ongoing

End tbl. 1

1	2	3	4	5	6	7	8	9	10	11	12	13	14
9	Novovolynsk ESCO project [21]	Energy efficiency	ESCO/EPC	15	2	4	4	3	Municipal EPC, EE program support	LED / energy audit / control	Open tenders, standard EPC mechanisms	Payment discipline, tariff volatility	Ongoing
10	Cherkasy ESCO project [21]	Energy efficiency	ESCO/EPC	100	3	5	4	3	Municipal EPC, possible credit mechanism	Large-scale LED-modernization, control systems	Transparent procurement, standard ESCO guarantees	Technical / logistic, budget	Ongoing
11	Korosten ESCO lighting project [21]	Energy efficiency	ESCO/EPC	47.9	3	5	4	2	Municipal EPC (11-year contract)	LED-modernization, 778 MWh annual saving	Public contract, known contractor	Operational service / O&M	Ongoing
12	Poltava street lighting (V-03 highway) [22]	Transport infrastructure	ESCO/EPC	20	2	4	4	2	Municipal EPC, possible IFI technical aid	LED modernization, road safety, dispatch control	Open procurement, municipal oversight	Contractual, supply	Ongoing

Source: compiled by the author based on data from Ministry of Economy of Ukraine, EBRD, IFC, ProZorro, [13]

Table 2

## Average parameter values of eco-PPPs by sectors in Ukraine

Sector	G	E	T	R
Maritime transport	4.33	3.67	4.00	3.00
Energy efficiency	2.40	4.80	4.20	2.60
Municipal infrastructure	3.00	5.00	5.00	2.00
District heating	4.00	4.00	5.00	3.00
Wastewater management	3.00	5.00	4.00	3.00
Transport infrastructure	2.00	4.00	4.00	2.00

Source: author's calculations.

and State support on the effectiveness and resilience of environmental partnerships within the eco-PPP framework.

The results of the study make it possible to formulate a set of general propositions that reflect the internal logic of environmentally oriented PPPs within the national economy. State support ( $G$ ) and institutional trust ( $T$ ) act as mutually reinforcing factors that determine the stability and performance of eco-PPPs. Their synergy creates the preconditions for stable cooperation, reduces informational asymmetry, and facilitates the alignment of public and private interests. The environmental orientation of the contract ( $E$ ) does not diminish investment attractiveness, provided that compensatory instruments – such as the involvement of international financial institutions (IFOs), the application of EPC standards, and transparent tendering procedures – are in place. These instruments serve as trust catalysts, fostering a stable and transparent setting that enhances the predictability and attractiveness of “green” investments. A condition of risk neutrality ( $R \sim 3$ ) ensures rational behavior among participants, minimizes transaction costs, and encourages compliance with contractual obligations. It is precisely this moderate level of risk that generates the optimal balance between State security and business flexibility, without constraining the innovative potential of the partnership.

Institutional trust ( $T$ ) functions as a kind of behavioral “currency”, which converts into project stability, decision-making predictability, and shorter timeframes between preparation and implementation phases. A high level of trust reduces transaction and coordination costs, which serves as a key determinant of efficiency in an environment of bound rationality. Thus, the empirical analysis of Ukrainian eco-PPPs demonstrates that economic efficiency and environmental sustainability are achieved not through opposition, but through the alignment of incentives. The implementation of projects with high values of  $G$  and  $T$  confirms the formation of behavioral equilibrium ( $U_p \approx U_s$ ), where the expected utilities of the public and private sectors converge. This provides the foundation for considering eco-PPP as an institutional instrument of Ukraine’s long-term sustainable development policy.

The results of the empirical verification of the eco-PPP model indicate that the effectiveness of environmentally oriented partnerships is determined less by the scale of financing and more by the quality of the institutional environment, the level of mutual trust between the parties, and the balance between environmental and economic incentives. This finding aligns with the principles of the behavioral-economic ap-

proach, according to which investor rationality is shaped not only by the expected financial return, but also by the subjective perception of risk, the stability of public policy, and the transparency of support mechanisms.

Behavioral equilibrium within environmentally oriented PPPs reflects a state of alignment between expectations, incentives, and outcomes shared by the public and private sectors. It emerges under conditions where the level of government support and institutional trust is sufficiently high ( $G \geq 4$ ,  $T \geq 4$ ), while risk remains within a moderate range ( $R \sim 3$ ). In such a configuration, both parties demonstrate utility symmetry, indicating the presence of a stable balance of interests. From the standpoint of economic policy, behavioral equilibrium represents an integrative outcome of three types of incentives: economic, through State guarantees, tax or tariff preferences that reduce financial uncertainty; institutional, via transparent procedures, engagement of international financial institutions, and professional project facilitation; behavioral, via accumulated trust, enhanced predictability of decisions, and reduced subjective perception of risk. Thus, behavioral equilibrium is not merely a by-product of isolated factors but a systemic attribute of partnership that determines its resilience in a dynamic environment. It ensures the alignment of motivational orientations, minimizes transaction and coordination costs, and establishes the preconditions for the sustainable operation of eco-PPPs.

The study revealed that environmental requirements ( $E$ ) do not diminish the attractiveness of partnerships when accompanied by adequate government support mechanisms. In projects such as EBRD Green Cities or ESCO contracts, high environmental standards are effectively combined with financial or organizational support instruments, creating synergy between ecological objectives and economic benefits. This finding challenges the common assumption that strengthening environmental obligations inevitably reduces investment motivation. On the contrary, within a balanced system of incentives, the environmental requirement becomes an integrative factor that enhances the legitimacy, reputational value, and public acceptability of projects. The trust factor ( $T$ ) proves decisive for the stability of eco-PPPs, as evidenced by consistently high values across all analyzed cases. Trust functions as a behavioral moderator, mitigating perceived risk, increasing the parties’ willingness for long-term cooperation, and ensuring the predictability of partnership relations. From a policy perspective, the institutionalization of trust – through the establishment of professional PPP management agencies, transparent competi-

tive procedures, public reporting, and the engagement of international experts – should be regarded not as a procedural formality, but as a foundational instrument of economic stability and partnership legitimacy.

**Conclusion and prospects for further research.** The synthesis of the research findings allows the identification of three key strategic directions for the development of environmentally oriented partnerships in Ukraine:

- institutional strengthening – the establishment of a resilient governance system for eco-PPPs that ensures transparency, professional oversight, and control over the fulfillment of environmental standards;
- financial and behavioral stimulation – the creation of a favorable motivational environment for business through State guarantees, tax incentives, donor participation, and compensation for green costs;
- climate-innovation integration – the orientation of eco-PPPs towards technological solutions that simultaneously reduce emissions, enhance energy efficiency, and strengthen the competitiveness of the Ukrainian economy.

The results confirm that environmentally oriented PPPs serve as an efficient institutional and behavioral mechanism of sustainable development, combining economic incentives, trust, and environmental responsibility within a unified motivational framework. The developed analytical model enables a quantitative determination of the conditions required to achieve behavioral equilibrium between the State and private investors, ensuring interaction stability and alignment of strategic goals. Empirical evidence demonstrates that the optimal configuration of parameters delivers the highest implementation efficiency for environmentally focused projects without compromising economic feasibility. Environmental orientation does not reduce investment attractiveness when adequate compensatory mechanisms are in place, while institutional trust functions as a critical intangible asset, lowering transaction costs and enhancing business readiness to participate in green initiatives.

From a practical standpoint, the results provide a scientific foundation for developing a national Green PPP Framework, designed to regulate environmental criteria, guarantee standards, risk assessment, and sustainability monitoring. The implementation of such a framework would enhance the effectiveness of post-war recovery and accelerate Ukraine's integration into the European system of sustainable investment. At the same time, future research should focus on exploring the behavioral determinants of private investor participation in green projects – particularly the role of reputation, public perception, and political stability; assessing the cumulative socioeconomic effects of eco-PPPs at the regional level, including their multiplier impacts on employment, local environmental quality, and energy security; and developing institutional models for eco-PPP governance, potentially envisioning the establishment of a National agency or Fund for sustainable partnerships responsible for guaranteeing, monitoring, and certifying environmentally oriented projects.

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