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MODELING STRATEGIES FOR THE EQUILIBRIUM OF SOCIO-ECONOMIC SYSTEMS OF ADAPTIVE CORPORATE MANAGEMENT OF PUBLIC-PRIVATE PARTNERSHIP PROJECTS IN ACADEMIC ENTREPRENEURSHIP IN THE CONTEXT OF POST-WAR RECOVERY

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Abstract
The article presents an integrated scientific and methodological model for modeling strategies for the equilibrium of socio-economic systems in the context of adaptive corporate management of public-private partnership projects in the field of academic entrepreneurship in the context of post-war recovery. The proposed approach combines the tools of integral analysis, stochastic differential equations and multi-criteria optimization, which allows describing the complex interaction between participants in partnership relations, taking into account dynamics, risks, time shifts of the effect, as well as strategic, economic and social goals that are heterogeneous in their content and significance. Thus, the model provides a mathematical platform for implementing adaptive management in conditions of uncertainty, which is a necessary condition for effective planning in academic entrepreneurship. The agent-oriented structure of the model allows taking into account the individual preferences of each participant in the system, reflected in the form of an intertemporal benefit function, where discounting shows a tendency towards short-term or long-term goals. Modeling on the example of twenty hypothetical objects with different weight configurations allowed to obtain a range of possible values of the optimal intensity of participation in the project, which depend on the priorities given to individual criteria. The results obtained can be used as an analytical basis for strategic planning, the formation of partnerships within the framework of public-private agreements, preliminary profiling of potential participants, as well as a tool for supporting decision-making in a dynamic environment. The developed model is capable of further adaptation by taking into account the specifics of the industry, region, level of institutional maturity and social capital, which ensures its practical relevance.

Keywords: *Adaptive Corporate Management, Equilibrium Strategy, Public-Private Partnership, Academic Entrepreneurship, Socio-Economic System, Stochastic Modeling, Strategic Planning, Post-War Recovery.*

JEL Codes: *C61, D21, H43, L31, O21, Q01, R58.*

Introduction

In the current conditions of post-crisis, and especially post-war restoration of socio-economic systems, the key challenge is the formation of effective management models that are able to combine economic feasibility, social stability and strategic innovation. One of the most promising areas of such a combination is the development of

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adaptive corporate management within the framework of public-private partnership projects implemented in the field of academic entrepreneurship. Academic entrepreneurship, being a hybrid form of interaction between science, education, state institutions and business, becomes particularly relevant in the context of the country's reconstruction, when it is necessary to simultaneously develop innovative infrastructure, stimulate employment and increase the level of human capital. However, the effectiveness of such projects largely depends on the system's ability to adapt to a changing environment, including political, economic, technological and social factors. A particular difficulty is the fact that participants in public-private partnerships have different, often inconsistent goals, and the implementation of projects takes place in conditions of uncertainty, limited resources and complex multifactorial interaction. In this context, formal modeling of the behavioral strategies of participants in such a system becomes necessary, taking into account not only their individual benefit functions, but also collective equilibrium in dynamic time and stochastic space. The model proposed in the article is based on the integration of several key scientific approaches: mathematical equilibrium theory, stochastic modeling, agent-oriented management and multi-criteria optimization. It allows not only to theoretically describe the functioning of adaptive corporate management, but also to calculate optimal strategies in specific conditions, simulate the behavior of partners and cluster objects according to their management logic. The model creates opportunities for predicting project effectiveness, optimal resource allocation and the formation of balanced policies in the field of public-private interaction. The purpose of this article is to develop and substantiate a model of equilibrium strategies for socio-economic systems of adaptive corporate governance in the field of academic entrepreneurship in the context of post-war recovery, which takes into account the multi-vector nature of goals, the stochasticity of the environment, and the intertemporal dynamics of benefits.

Review of scientific literature sources

In the context of post-war recovery, modeling of equilibrium strategies in socio-economic systems requires reliance on a wide interdisciplinary body of research. The literature selection was carried out taking into account the need to combine the concepts of sustainable development, public-private partnership, innovative management and educational entrepreneurship.

Kusakabe (2013) explores local practices of sustainable development in Japanese cities through the concept of “machizukuri”, which provides useful parallels for the formation of partnership strategies in post-crisis conditions. The indicated source is relevant when modeling equilibrium strategies taking into account urban and socio-cultural factors. Bakhmat et al. (2022) analyze the management of the quality of higher education in the context of sustainable development, which creates a basis for studying transformations in academic entrepreneurship. The work is relevant in studying the adaptability of educational institutions in the system of public-private partnership. Murray Mas et al. (2017) examine the impact of crises on the spatial formation of tourist regions, demonstrating the importance of socio-economic adaptation mechanisms. Their analysis allows us to better understand the restructuring of economic models in times of instability. Gryshchenko et al. (2023) present approaches to the formation of an innovative environment in the conditions of post-war recovery, which is directly related to the topic of academic entrepreneurship. This source provides examples of the integration of social space and entrepreneurial activity.

Willett (2005) criticizes neoliberal approaches to peace in Africa, which allows us to understand the risks of external intervention in management structures. The work is relevant for analyzing the impact of the political context on socio-economic systems. Bosniuk et al. (2021) examine the social aspects of the professional activity of psychologists, which indicates the importance of the humanitarian factor in change management.

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Wijk (2007) in his dissertation describes the role of airports in urban regions, in particular in the formation of spatial and economic structures. Its concepts can be used in the study of infrastructure solutions within the framework of public-private partnerships. Hnatenko et al. (2024) provide an analysis of the Ukrainian renewable energy market, which allows illustrating the impact of economic fluctuations on strategic investments. The work is important for assessing the flexibility of projects in the field of sustainable development.

Kleinberger (2016) analyzes the Israeli education system and its interaction with the social structure, which allows extrapolating the conclusions obtained to educational projects of public-private partnerships. The work is relevant in building an academic environment in new conditions. Kubitskyi et al. (2023) focus on the modern development of higher education, which allows assessing the potential of universities as entrepreneurial structures. This study is relevant in the context of the post-war transformation of the academic sector.

De Sousa et al. (2023) review research on brownfield revitalization in the United States over the past three decades, which opens up opportunities for analyzing the secondary use of resources within public-private partnership projects. This approach is useful for the environmental component of academic infrastructure restoration. Beramendi et al. (2015) consider the systemic crisis of advanced capitalism, which allows us to theoretically understand the conditions under which new partnership models are formed. This source is important for understanding the general economic background of public-private management. Hnatenko et al. (2020) analyze the infrastructure of innovative enterprises in a market environment, which is important for building strategies in public-private partnership projects. Their approach allows us to identify factors for the successful adaptation of business models.

Kesar and Rimac (2011) study the development of medical tourism in Croatia, demonstrating the synergy of public planning and private capital. The above example can be adapted for educational and medical initiatives in the post-war period. Purdenko et al. (2023) focus on the financial management of ecological entrepreneurship, offering examples of effective financial models. This source forms the financial basis for innovative projects. Mazur et al. (2021) study the improvement of controlling in the financial management of enterprises, which allows for the detailed development of management mechanisms. The study we have considered is useful for strengthening corporate governance in the partnership system. Kross (2013) analyzes social welfare capitalism in East Asia, in particular in South Korea, which expands the understanding of Asian models of public-private partnership. The work we mentioned provides a comparative approach to the development of equilibrium strategies. Mykhailichenko et al. (2021) examine competitive HRM strategies in the agricultural sector with a focus on digitalization. Their findings are relevant for HRM in educational entrepreneurship. Yeoh and Kong (1994) examine the cultural and political aspects of Singapore's urbanism, which allows for an interpretation of the interaction between space and power. This is important for shaping the institutional environment of academic centers. Prokopenko et al. (2021) analyze models of public governance of clustering in the context of globalization, which allows for a better understanding of inter-institutional coordination. The work is particularly relevant for the formation of innovation networks in the system of public-private partnerships.

Patel (2013) in his work on the "long green revolution" analyzes the socio-economic consequences of transformations in agriculture and their impact on the sustainability of food systems. Such ideas are important for understanding the structural restructuring of enterprises in the period of post-conflict development. Prylipko et al. (2021) presented an approach to regional innovation management that integrates human resources, financial and foreign policy. This supports the methodology of strategic profiling in adaptive systems. Appiah et al. (2024) et al. investigated gender mainstreaming in the political economy of energy access, highlighting the role of inclusion in resource management. Their experience can be extrapolated to academic

entrepreneurship as a mechanism for the participation of vulnerable groups. Semenov et al. (2021) analyze the management of energy-saving innovation projects in agri-food enterprises. The work emphasizes the importance of resource efficiency in post-crisis reconstruction of industries. Nchake (2025) raises the issue of green transformation in Africa, which creates parallels to the Ukrainian post-war context in terms of the need for a new environmental policy. The work is relevant for systemic changes in the regional economy. Shumilova et al. (2023) study the formation of emotional and ethical competence of future managers in education, which is important for the social aspect of adaptive management in the academic environment.

Gonçalves et al. (2023) analyze the challenges in metropolitan management, focusing on decision-making processes. The study illustrates the complexity of inter-institutional coordination, which is relevant for public-private partnership projects. Voznyuk et al. (2022) proposed synergistic modeling of management processes in the field of education, which reinforces the idea of autonomous teams in corporate project management. The work has applied value for organizational engineering. Reiner and Benner (2022) consider the bias towards cooperation in regional policy, emphasizing the underestimation of competition. This allows us to understand the risks of imbalance in strategic planning of partnerships more deeply. Zhyvko et al. (2024) study the impact of the US stock market on the security strategy of innovation management. Their conclusions are applicable to the formation of investment policy in the conditions of global economic turbulence. Coppola (2015) in his work on international organizations and financial institutions offers a conceptual framework for the integration of multi-level actors in the process of responding to emergencies. This actualizes the role of international support in the post-war restoration of systems. The sources involved represent both the theoretical foundations of adaptive corporate governance and applied research in the field of infrastructure planning, financial analytics, social capital and urbanism. They create a reliable methodological basis for building a comprehensive equilibrium model adapted to the conditions of instability and transformational changes, but require a deepening of the methodological and scientific basis taking into account the present.

Research methods

In the process of studying the strategies of equilibrium of socio-economic systems of adaptive corporate management, implemented in public-private partnership projects in academic entrepreneurship, a comprehensive methodological approach was applied, based on a combination of several interconnected analytical levels. The research method was based on the fact that socio-economic systems in the conditions of post-crisis recovery are characterized not only by multi-level and interdependence of components, but also by a tendency to uncertainty, asymmetry of information, time shifts in the results of management decisions and complex dynamics of changes in external parameters. This implied the need for formalization of processes through analytical models capable of taking into account the interaction of rational and limitedly rational agents, taking into account both economic and strategic and social factors.

The conceptual basis for the construction of the study was the synthesis of the provisions of modern economic and mathematical theory with the tools of applied optimization. A model of the subject's benefit was formulated in an integral form, which made it possible to take into account the temporal dynamics of the influence of both the subject's own actions and the strategic context in which other players operate. At the same time, the introduction of discounting created the basis for modeling intertemporal choice, which is typical for long-term partnership projects in the field of academic entrepreneurship. The definition of the benefit function as the integral of profitability minus costs, taking into account the exponential decrease in the significance of future effects, made it possible to reflect the real behavior of agents for whom decision-making is a function of both current costs and deferred benefits.

Since the research is carried out in the context of the post-war economy, it was necessary to take into account the stochastic nature of

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changes in the external environment, which was implemented through the use of stochastic differential equations, in particular the Ito equation, which describes the random dynamics of the system states under the influence of both controlled and uncontrolled factors. This approach provides increased realism of the model, allowing to take into account fluctuations in state support, unpredictable changes in the availability of resources or technologies, as well as adaptation of the behavior of partners. The stochastic component of the model allows not only to simulate risks, but also to formally derive optimal rules for responding under conditions of uncertainty.

Within the concept of multi-criteria, which is inherent in public-private partnership projects, a model of convolution of several objective functions into a single compromise function was built. The use of weight coefficients allowed changing the relative importance of the criteria depending on management priorities, political attitudes or features of a specific stage of project implementation. The compromise function was formed as a sum of weighted individual functions describing economic efficiency, strategic potential and social feasibility. This format allows formalizing the polycentric nature of management, which is typical for partnerships between public and private entities that have different goals, but a common resource and implementation space. To calculate optimal strategies, analytical methods for solving first-order equations were used. Differentiation of the compromise function made it possible to find critical points that are candidates for the maximum, and therefore, for optimal strategic intensity. Such values were estimated for each combination of weights, which allowed creating a simulation field of scenarios. In order to verify the hypotheses and generalize the conclusions, hypothetical observation objects were modeled, each of which had its own unique structure of weight coefficients, which made it possible to build an empirical base for further clustering. To generalize the results and identify structural patterns, cluster analysis methods were used. In particular, segmentation of objects was carried out according to the parameters of weight coefficients, which allowed us to identify three dominant types of strategic behavior - intensive-expansionary, balanced and conservative-social. Visualization in the form of graphs in two-dimensional space helped to isolate the internal connections between the weight of strategic goals and the optimization result. Thus, the research method was built as a holistic system of mathematical simulation analysis, which allows us to formalize the behavioral dynamics of subjects in the context of post-war recovery through the tools of the theory of equilibrium, optimization and probabilistic forecasting.

Results

Within the framework of adaptive corporate management of public-private partnership projects implemented in academic entrepreneurship in the post-war recovery, the equilibrium strategy in the socio-economic system can be described on the basis of the integral benefit function of each subject. It takes into account the profit from participation in the project, the costs of implementing obligations, and discounting over time:

$$Ui(x) = \int 0T\left[\pi i(xi(t), x - i(t), t) - ci\left(xi(t)\right)\right]e^{-\rho t}dt \quad (1)$$

where πi is the profit function of subject i, which depends on both its own actions and the actions of other participants in the system; ci is the cost function; ρ is the time advantage coefficient (discounting); T is the planning horizon.

Taking into account the stochastic nature of external influences, in particular unpredictable fluctuations in public funding, logistical barriers or changes in the regulatory environment, is modeled through the stochastic differential equation “Ito”:

$$dxt = \mu(xt, t)dt + \sigma(xt, t)dWt \quad (2)$$

where μ is a function of deterministic dynamics, σ is the diffusion coefficient (volatility), Wt is the Wiener process (Brownian motion), which models the randomness in the change of the state of the system.

When the model acquires an agent-oriented structure, each participant (agent) makes a decision based on an individual benefit function, which is formed as the expected value of the intertemporal difference between income and loss, taking into account the coefficient of time advantage:

$$Ji = t = 0\sum T\beta t(Ri(t) - Li(t)) \quad (3)$$

where $Ri(t)$ is the benefits of agent i at time t; $Li(t)$ is the corresponding losses; $\beta \in (0,1)$ is the discount factor.

Optimization of the actions of all participants is modeled as a vector multi-criteria optimization problem, which takes into account multidirectional goals: social sustainability, economic efficiency, scientific innovation. Formally:

$$\max_{x \in X} (f1(x), f2(x), f3(x)) \quad (4)$$

where $f1, f2, f3$ are the corresponding utility or feasibility functions for each goal; X is the admissible space of strategies. To obtain a compromise solution, the convolution method with weight coefficients is used.

We continue the methodology by including an example of a trade-off multi-criteria optimization model, which demonstrates how participants in adaptive corporate governance can reconcile different goals in a single strategy.

Within the framework of the multi-criteria model, three key criteria are considered: economic efficiency, strategic growth, and social value of the project. Let the utility functions of each criterion be given in the form:

$$f1(x) = 2x - x2, f2(x) = 3x, f3(x) = -x2 + 4 \quad (5)$$

where the variable x denotes the intensity of resource involvement in the project, and the functions themselves are the return estimate for each criterion in normalized units. To achieve a balanced solution, a compromise function with weighting coefficients is used:

$$F(x) = w1f1(x) + w2f2(x) + w3f3(x) = w1(2x - x2) + w2(3x) + w3(4 - x2) \quad (6)$$

where $w1 + w2 + w3 = 1, wi \in [0,1]w\_i \setminus in\ [0,1]wi \in [0,1]$. Such a convolution allows us to represent a multi-criteria problem in a scalar form suitable for optimization. Depending on the values of the weights $w1, w2, w3$, the management strategy may favor one of the criteria or seek a true balance.

We conclude the modeling stage by logically summarizing it with a mathematical result.

The compromise objective function, which aggregates three criteria (economic efficiency, strategic growth and social value), has the form:

$$F(x) = w1(-x2 + 2x) + 3w2x + w3(4 - x2) \quad (7)$$

The optimal strategy involves maximizing this function, which is implemented by finding critical points. Differentiating the function $F(x)$, we obtain:

$$F'(x) = w1(2 - 2x) + 3w2 - 2w3x \quad (8)$$

Solving the equation $F'(x) = 0$, we obtain the optimal equilibrium point of the system:

$$x * = w1 + \frac{3}{2w2}/w1 + w3 \quad (9)$$

This result demonstrates the adaptability of the model to changing priorities. For example, under the conditions of increasing the weight of the social factor $w3$, the value of $x *$ decreases, which is interpreted as a redistribution of resources from the most intensive use in favor of stable and socially oriented growth.

Thus, the proposed model provides an instrumental approach to the formation of a balanced equilibrium strategy in socio-economic systems of adaptive management of public-private partnership projects. It allows taking into account uncertainty, taking into account multi-criteria priorities and provides an algorithmic basis for practical application in the environment of academic entrepreneurship in the conditions of post-war recovery. So, Table 1 shows the modeling results for 20 hypothetical objects.

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Table 1. Results of modeling the optimal equilibrium point of the system

Object number	w1	w2	w3	x* (optimal strategy)
1	0.182	0.462	0.356	1.626
2	0.657	0.171	0.171	1.103
3	0.038	0.568	0.394	2.06
4	0.417	0.012	0.571	0.44
5	0.679	0.173	0.148	1.135
6	0.181	0.301	0.518	0.905
7	0.324	0.218	0.458	0.832
8	0.175	0.366	0.459	1.142
9	0.317	0.545	0.139	2.488
10	0.446	0.514	0.04	2.504
11	0.721	0.202	0.077	1.283
12	0.348	0.355	0.297	1.365
13	0.28	0.09	0.63	0.456
14	0.416	0.115	0.468	0.666
15	0.029	0.756	0.215	4.766
16	0.443	0.209	0.348	0.956
17	0.321	0.109	0.57	0.544
18	0.297	0.36	0.343	1.308
19	0.372	0.573	0.055	2.884
20	0.346	0.08	0.574	0.507

**Source: calculated by the authors.*

The results of clustering modeling of the optimal equilibrium point of the system are shown in Fig. 1.

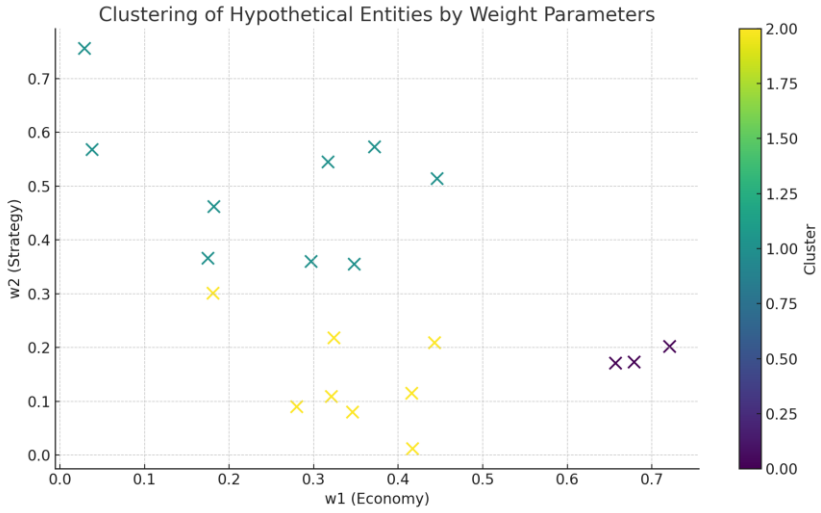

Figure 1. Results of clustering simulation of the optimal equilibrium point of the system
**Source: calculated by the authors.*

For an even deeper understanding of the strategic potential of adaptive corporate governance within the framework of public-private partnership projects, it is advisable to carry out a comprehensive analysis of the results of the equilibrium model obtained for twenty hypothetical objects. Tabular values and clustering results in a two-dimensional space of weight parameters allow for a structural and behavioral assessment of the types of objects that can be involved in academic entrepreneurship projects. The distribution of optimal values of the strategic variable $x*$ in the sample demonstrates significant variability, which is directly due to the proportional relationship between the weights assigned to the economic $(w1)$, strategic $(w2)$

and social ($w3$) criteria. In particular, objects with a dominance of the parameter $w2$ show a tendency to increased values of x∗, which is interpreted as a strategy of active use of resources in the short and medium term. At the same time, objects with a high weight of the social component $w3$ demonstrate relatively lower values of $x*$, which indicates a balanced approach to the system load, focused on stability and long-term effect. Clustering in the space of weight coefficients allows us to identify three stable groups of objects. The first group includes projects dominated by strategic orientation - their positioning on the graph indicates a desire for aggressive growth with minimal consideration of social balance. The second group represents objects with a balanced structure of priorities, which form the so-called compromise strategy. It involves flexible maneuvering between economic feasibility, strategic focus and social responsibility. The third group is the most conservative, its representatives attach the greatest importance to social aspects. On the clustering plane, these objects are located in the area with high values of $w3$ and low values of $w2$, which indicates the choice of a model of stable, gradual development with low risk.

Data analysis also shows that in the case of an increase in the share of the economic criterion w1 without a significant increase in $w2$, the strategy $x*$ does not demonstrate high values. This confirms the theoretical assumption that only in the context of economic indicators can a high level of operational intensity be achieved - the economic component by itself is not a sufficient driver of activity. At the same time, the presence of the weight $w2$ even with a relatively modest $w1$ creates a multiplicative amplification effect, which can be explained by the fact that the strategic orientation involves not only the current expenditure of resources, but also the expansion of potential, in other words - the accumulation effect.

Based on the graph, one can also note a certain density of objects in the center of the coordinate space. This indicates the predominance of objects with close values of $w1$ and $w2$. Such a crowded distribution indicates the existence of a tendency to unify weight priorities, possibly due to political and economic factors in the conditions of post-war reformatting. At the same time, the presence of objects on the periphery, especially with high $w3$, can be interpreted as an alternative strategy - for example, by state or non-profit institutions focused on long-term institutional stability instead of quick returns.

The results obtained indicate the need for an adaptive approach to the formation of partnerships. In particular, it is advisable to combine projects with different weight structures, which allows building a multi-level system of balancing risks and resources. In practical terms, this means that at the stage of selecting partners and projects, preliminary clustering or profiling of participants according to the $w1 - w3$ criteria should be carried out, which will allow predicting their behavior within the framework of the equilibrium model and more effectively distributing functions within the framework of the implementation of public-private agreements.

In general, it can be stated that the modeling conducted allows not only to identify the patterns of strategic behavior of objects in the adaptive corporate management system, but also offers a practical tool for forecasting, managing and correcting strategies in the dynamic environment of post-crisis recovery. The flexibility of the model, its ability to take into account many criteria and reflect stochastic components makes it relevant for making management decisions in complex socio-economic systems, where the factor of uncertainty and multi-vectority is constantly present.

Conclusions

As a result of the research, a holistic scientifically based model of equilibrium strategies of socio-economic systems in the field of adaptive corporate management was formed, which takes into account the complex nature of public-private partnership projects in the post-crisis recovery. The main scientific novelty was the combination of the mathematical apparatus of integral modeling of benefits, stochastic equations for a dynamic environment, agent-oriented approach and multi-criteria optimization into a single analytical framework that allows you to

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accurately describe, predict and optimize the strategic behavior of participants in partnership relations in the field of academic entrepreneurship. The proposed model allowed us to derive the formula for the optimal point of strategic equilibrium as a function of the weight coefficients of three key criteria - economic, strategic and social. This ensured the flexibility of the system and made it possible to adapt the model to various management scenarios. In particular, the analytical representation of the compromise function of the objective through weights made it possible to show that the increase in the significance of the social factor leads to a decrease in the intensity of resource use, while the predominance of the economic or strategic aspect contributes to a more aggressive and dynamic growth model. This approach is extremely relevant in the post-war period, when strategic guidelines often change, and social stability and recovery are no less important than economic profitability.

Modeling twenty hypothetical objects allowed not only to test the optimization formula, but also to demonstrate the range of strategic variations depending on the distribution of weights. The constructed simulation and graphical clustering of objects made it possible to identify three typical strategies: the first - with a priority of strategic development, the second - with a balanced distribution of weights, and the third - with the dominance of the social aspect. Such typology can be used in the practical field for preliminary diagnostics of potential partners, formation of balanced consortia, as well as construction of multi-level models of project implementation, where each partner performs a role according to the internal profile of advantages.

The results of cluster analysis allowed to empirically confirm theoretical propositions regarding the relationship between the structure of priorities and the expected effect of strategy implementation. Objects with a high value of the strategic component in most cases had the highest values of optimal intensity, which indicates the ability to mobilize resources, risky investments and rapid scaling. At the same time, participants for whom the social component is a priority demonstrated a stable but less intensive development model, which is appropriate in cases of long-term programs of academic renewal and human capital development. Such differentiation provides the possibility of reasonable balancing of risks in the overall partnership system.

The study also found that the presence of weight asymmetries in priorities can be both a resource for synergy and a source of conflict. In the case of the correct configuration of partners, that is, their complementarity in priorities, there is a mutual complementarity of functions and roles, which enhances the overall result. In contrast, a mismatch in strategic settings can lead to inconsistency of decisions, conflicts in the allocation of resources, or inefficiency in the implementation of joint tasks. In this context, the proposed equilibrium model can be used as a tool for preliminary assessment of compatibility and adaptation of partner strategies. The systematic approach is also manifested in the model's ability to capture time dynamics. Taking into account discounting allows modeling the effect of time preferences, which is especially important in the post-crisis economy, when the value of short-term benefits may temporarily outweigh long-term goals. The above is taken into account in the integral benefit function, which not only reflects the expected benefit, but also allows us to take into account the psychological and resource cost of delaying the result.

In conclusion, it can be noted that the developed model has broad prospects for further development both in the direction of detailing individual components (for example, the introduction of institutional or regional parameters), and in the direction of practical implementation in decision-making support systems. It opens up new opportunities for predictive modeling, strategies for adapting to changing conditions, policy formation in the field of partnership management and the development of academic entrepreneurship on the basis of sustainable growth. Thus, the presented modeling system not only deepens the theoretical understanding of the dynamics of partnership projects, but also provides an applied basis for effective management in conditions of strategic uncertainty and complex post-crisis recovery.

References

Kusakabe, E. (2013). Advancing sustainable development at the local level: The case of machizukuri in Japanese cities. *Progress in Planning*, *80*, 1-65. https://doi.org/10.1016/j.progress.2012.06.001

Bakhmat, N., Voropayeva, T., Artamoshchenko, V., Kubitskyi, S., & Ivanov, D. (2022). Quality Management in Higher Education in Terms of Sustainable Development. *International Journal for Quality Research*, *16*(4), 1107-1120. http://dx.doi.org/10.24874/IJQR16.04-10

Murray Mas, I., Yrigoy Cadena, I., & Blázquez-Salom, M. (2017). The role of crises in the production, destruction and restructuring of tourist spaces. The case of the Balearic Islands. *Investigaciones Turísticas*, (13), 1-29. https://doi.org/10.14198/inturi2017.13.01

Gryshchenko, I., Ganushchak-Efimenko, L., Hnatenko, I., & Rębilas, R. (2023). Management of environment design of the development of innovative entrepreneurship at integrated structures under the conditions of post-war reconstruction. Financial & Credit Activity: Problems of Theory & Practice, *5*(52), 341-352. https://doi.org/10.55643/fcaptp.5.52.2023.4199

Willett, S. (2005). New barbarians at the gate: Losing the liberal peace in Africa. *Review of African Political Economy*, *32*(106), 569-594. https://doi.org/10.1080/03056240500467062

Bosniuk, V., Ostopolets, I., Svitlychna, N., Miroshnichenko, O., Tsipan, T., & Kubitskyi, S. (2021). Social Content of Psychological Specialists' Professional Activity. *Postmodern Openings*, *12*(1), 01-20. https://doi.org/10.18662/po/12.1/242

Wijk, M. V. (2007). *Airports as cityports in the city-region: spatial-economic and institutional positions and institutional learning in Randstad-Schiphol (AMS), Frankfurt Rhein-Main (FRA), Tokyo Haneda (HND) and Narita (NRT)* (Doctoral dissertation, Koninklijk Nederlands Aardrijkskundig Genootschap).

Hnatenko, I., Bebko, S., Ievseitseva, O., Kvita, H., & Zos-Kior, M. (2024). Market analysis of the renewable energy market of Ukraine in the context of changes in financial and economic processes. Financial and credit activity: problems of theory and practice. Volume 5 (58), 446-459. https://doi.org/10.55643/fcaptp.5.58.2024.4576

Kleinberger, A. F. (2016). *Society, Schools and Progress in Israel: The Commonwealth and International Library: Education and Educational Research*. Elsevier.

Kubitskyi, S., Shorobur, I., Yevdokymova, N., Vlasiuk, T., & Shevchuk, L. (2023). Development of higher education institutions in the current conditions. *Cadernos de Educação Tecnologia e Sociedade*, *16*(se2), 119-128. https://doi.org/10.14571/brajets.v16.nse2.119-128

De Sousa, C., Carroll, A. M., Whitehead, S., Coffin, S., Heberle, L., Hettiarachchi, G., ... & Van Der Kloot, J. (2023). A review of brownfields revitalisation and reuse research in the US over three decades. *Local Environment*, *28*(12), 1629-1654. https://doi.org/10.1080/13549839.2023.2248625

Beramendi, P., Häusermann, S., Kitschelt, H., & Kriesi, H. (2015). Conclusion: Advanced capitalism in crisis. *The politics of advanced capitalism*, 381-403.

Hnatenko, I., Kuksa, I., Naumenko, I., Baldyk, D., & Rubezhanska, V. (2020). Infrastructure of innovation enterprise: features of formation and regulation in modern market conditions. *Management Theory and Studies for Rural Business and Infrastructure Development*, *42*(1), 97-104. https://doi.org/10.15544/mts.2020.10

Kesar, O., & Rimac, K. (2011). Medical tourism development in Croatia. *Zagreb International Review of Economics & Business*, *14*(2), 107-134. https://hrcak.srce.hr/78762

Purdenko, O., Artyushok, K., Riazanova, N., Babaiev, I., Kononenko, A., Lepeyko, T., & Zos-Kior, M. (2023). Financial management of innovative eco-entrepreneurship. *Management Theory and Studies for Rural Business and Infrastructure Development*, *45*(2), 152-165. https://doi.org/10.15544/mts.2023.16

Mazur, N., Khrystenko, L., Pásztorová, J., Zos-Kior, M., Hnatenko, I., Puzyrova, P., & Rubezhanska, V. (2021). Improvement of Controlling in the Financial Management of Enterprises. *TEM Journal: Technology, Education, Management, Informatics*, *10*(4), 1605-1609. https://doi.org/10.18421/TEM104-15

Kross, K. (2013). *Developmental welfare capitalism in East Asia with a special emphasis on South Korea* (No. 2013-05). Ordnungspolitische Diskurse. https://hdl.handle.net/10419/77938

Mykhailichenko, M., Lozhachevska, O., Smagin, V., Krasnoshtan, O., Zos-Kior, M., & Hnatenko, I. (2021). Competitive strategies of personnel management in business processes of agricultural enterprises focused on digitalization. Management Theory and Studies for Rural Business and Infrastructure Development, 43(3), 403–414. https://ejournals.vdu.lt/index.php/mtsrbid/article/view/2519

Yeoh, B. S., & Kong, L. (1994). Reading landscape meanings: state constructions and lived experiences in Singapore's Chinatown. *Habitat International*, *18*(4), 17-35. https://doi.org/10.1016/0197-3975(94)90015-9

Prokopenko, O., Martyn, O., Bilyk, O., Vivcharuk, O., Zos-Kior, M., & Hnatenko, I. (2021). Models of State Clusterisation Management, Marketing and Labour Market Management in Conditions of Globalization, Risk of Bankruptcy and Services Market Development. *International journal of computer science and network security: IJCSNS*, *21*(12), 228-234. https://doi.org/10.22937/IJCSNS.2021.21.12.34

Patel, R. (2013). The long green revolution. *The Journal of Peasant Studies*, *40*(1), 1-63. https://doi.org/10.1080/03066150.2012.719224

eISSN 2345-0355. 2025. Vol. 47. No. 4: 585-595
Article DOI: https://doi.org/10.15544/mts.2025.46

Prylipko, S., Vasylieva, N., Kovalova, O., Kulayets, M., Bilous, Y., & Hnatenko, I. (2021). Modeling of Regional Management of Innovation Activity: Personnel Policy, Financial and Credit and Foreign Economic Activity. *International Journal of Computer Science & Network Security*, *21*(11), 43-48. https://doi.org/10.22937/ijcsns.2021.21.11.6

Appiah, S., Plutshack, V., Agradi, M., Klug, T. W., Nunoo, I., & Saparapa, R. (2024). The political economy of gender mainstreaming in energy access in Sierra Leone. *Environmental Research: Climate*, *3*(4), 045025.

Semenov, A., Kuksa, I., Hnatenko, I., Sazonova, T., Babiy, L., & Rubezhanska, V. (2021). Management of Energy and Resource-Saving Innovation Projects at Agri-Food Enterprises. *TEM Journal: Technology, Education, Management, Informatics*, *10*(2), 751-756. https://doi.org/10.18421/TEM102-32

Nchake, M. A. (2025). Green Transition, Trade Policy and Sustainable Development: An African Perspective. *Mohd Nayyer Rahman Nida Rahman*, 125.

Shumilova, I., Kubitskyi, S., Bazeliuk, V., Rudyk, Y., Hrechanyk, N., & Rozhnova, T. (2023). The System of Forming the emotional and ethical Competence of the Future education Manager in the conditions of transformational changes. *Ad Alta-Journal of Interdisciplinary Research*, *13*(2), 82-89. https://ep3.nuwm.edu.ua/28475/

Gonçalves, J., Pinto, P., & Santos, M. (2023). Who and how decides when and where? Drifts and deadlocks in metropolitan governance. *Urban Research & Practice*, *16*(3), 374-393. https://doi.org/10.1080/17535069.2022.2033308

Voznyuk A., Kubitskyi S., Balanovska T., Dorofyeyev O., & Chip L. (2022). Synergetic simulation of managing processes in educational sphere in the contest of temporary self-ruled managerial target teams application. *Financial and Credit Activity Problems of Theory and Practice*, 3(44), 317–327. https://doi.org/10.55643/fcaptp.3.44.2022.3749 https://fkd.net.ua/index.php/fkd/article/view/3749/3602

Reiner, C., & Benner, M. (2022). Cooperation bias in regional policy: Is competition neglected?. *The Annals of Regional Science*, *69*(1), 187-221. https://doi.org/10.1007/s00168-022-01114-0

Zhyvko, Z., Morhachov, I., Zhelikhovska, M., Artiukh-Pasiuta, O., Hnatenko, I., Skripnik, V., & Yanechko, S. (2024). The Influence of the US Stock Market on the Institutional Security Strategy of the Management of Innovative Development. *Management Theory and Studies for Rural Business and Infrastructure Development*, *46*(1), 104-111. https://doi.org/10.22937/IJCSNS.2024.24.11.11

Coppola, D. P. (2015). Participants–Multilateral Organizations and International Financial Institutions. *Introduction to International Disaster Management*, 588. https://doi.org/10.1016/B978-0-12-801477-6.00010-1