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THE MOTIVATIONAL MECHANISM FOR TRANSITION TO THE BIOECONOMIC PARADIGM OF ECONOMIC RECOVERY (RECONSTRUCTION)

Summary

The work is devoted to the theoretical and methodological substantiation of the motivational mechanism for the bioeconomic recovery (reconstruction) of the Ukrainian economy in the context of the Russian-Ukrainian war and post-war transformation. The scientific hypothesis is the contradiction between the declarative proclamation of a “green” bioeconomic course and the actual action of the institutional and motivational architecture, which still essentially reproduces resource- and carbon-intensive development trajectories. The work demonstrates that the presence of bio-oriented technologies, financial instruments, and regulatory requirements does not guarantee a transition to a new growth model unless they are integrated into the system of incentives, expectations, habits, and norms of behaviour of key actors at the macro-, meso-, and micro-levels. The purpose of the study is to conceptualise, institutionalise, and assess the motivational mechanisms of bioeconomic recovery as a holistic system that transforms its determinants into specific management decisions and results. The theoretical basis is the integration of neoclassical and Keynesian approaches, institutional and neo-institutional economics, evolutionary and behavioural economics, spatial-cluster theories and ecologically oriented concepts of sustainable development. The researchers proposed an essential and meaningful model of the motivational mechanism, in which the chain “needs – interests – motives – incentives – institutes – activity – results” is interpreted in the coordinates of the bioeconomic paradigm and post-war recovery. The institutional space is substantiated in the form of a three-dimensional structure that combines levels of analysis, functional subsystems and types of institutes. As a result, three key

groups of institutional motivators for bioeconomic recovery are identified: infrastructural, innovative, and investment. The study demonstrates their role in forming the motivational field and coordinating stakeholders' decisions. On this basis, researchers constructed integral indices of institutional capacity for individual motivators and a combined index of institutional capacity of the motivational mechanism as a whole. The scientific novelty lies in the combination of economic and philosophical interpretations of the motivational mechanism with an operationalised institutional and index model, compatible with the realities of war and post-war Ukraine, as well as European integration obligations. In practice, the proposed toolkit can be used to identify institutional "bottlenecks", prioritise infrastructural, innovative, and investment motivators and design policies that not only declare, but also motivationally consolidate the bioeconomic trajectory of post-war development.

Introduction

The military aggression against Ukraine has made the issue of economic recovery (reconstruction) relevant not as a technical task of rebuilding destroyed facilities, but as a deep review of development trajectories and their value, resource and environmental foundations. In conditions of multi-level shocks – demographic, production, fiscal, energy – the choice between returning to an inertial resource and carbon-intensive model and transition to a bioeconomic paradigm acquires not only an economic, but also a civilisation dimension. In this context, bioeconomy is an attempt to combine recovery and development based on renewable resources, circular models, low-carbon technologies, and respect for biophysical limits to growth, while not ignoring social justice and spatial balance.

At the same time, the transition to a bioeconomy does not occur as a direct consequence of the availability of appropriate technologies or external requirements. This is about a profound transformation in how short- and long-term benefits, private and public interests, economic efficiency, and environmental sustainability are correlated in the decisions of the state, businesses, territorial communities, and households. Therefore, the focus is on the motivational mechanism of recovery – a set of incentives, institutional frameworks, expectations and behavioural attitudes through which the determinants of the bioeconomic transition are “translated” into the language of specific actions. If this mechanism is set to support the traditional growth model, even the best-thought-out “green” policies risk remaining marginal or declarative.

Ukraine’s European integration course further complicates and, at the same time, enriches this picture. Approaching the European Green Deal, climate goals, and bioeconomy strategy creates a window of opportunity for attracting

resources, technologies and institutional experience, but sets strict requirements for the transparency, effectiveness and inclusiveness of policies. In this space, different logics intersect – the logic of reconstruction, the logic of security, the logic of market competition, and the logic of environmental responsibility. At the intersection of these logics, a motivational landscape is formed in which stakeholders make decisions about investments in bioenergy, agrobioprocessing, circular infrastructure, “green” innovations, and socially oriented practices.

Chapter 1. The essence and meaningful composition of the motivational mechanism in the coordinates of economic theory

We consider the bioeconomic paradigm of economic recovery (reconstruction) as a conceptual alternative to the resource-exhausting growth (recovery) model, which is based on a combination of economic, social, institutional-management, environmental and cognitive-technological factors. Its content is revealed through the use of bioclusters, “green” financing tools, digital monitoring systems, SMART control loops and other forms of organising regenerative processes that ensure the transition to renewable resources and low-carbon technologies. At the same time, the mere presence of determinants and organisational and institutional structures does not guarantee a change in the development trajectory, since the decisive factor is how they pass through the system of motivations of economic agents – the state, business, households, territorial communities, scientific and educational institutions – and are transformed into their specific decisions, priorities and behavioural strategies.

In the context of modern economic theory (classical, institutional, neo-institutional, behavioural, ecologically oriented, and development economics), the motivational dimension emerges as a key link connecting the system of determinants with the practical implementation of organisational and economic mechanisms. The modern Ukrainian context, marked by a combination of military shocks, profound structural reconfiguration of production systems and adaptation to European “green” standards, gives the motivational component the status of a critical conditional factor. Accordingly, whether bioeconomic guidelines will take the form of real investment decisions, innovative practices, consumption models, and local development strategies depends on how consistently and coherently incentives, expectations, norms and value orientations are built.

In this context, the motivational mechanism for transition to the bioeconomic paradigm of economic recovery (reconstruction) should be interpreted as a holistic multi-level integrated system that endogenises the needs, interests, motives and incentives of economic agents in the decision-making process, synthesises them with value-normative and institutional constraints and,

through a given configuration of formal and informal institutions, sets the mode of transformation of these parameters into results, that is, into stable behavioural trajectories oriented towards the implementation of bioeconomic decisions. In a generalised form, such a mechanism can be represented as a composition in which motivational and behavioural attitudes play the role of a channel for transmitting impulses from objective determinants and institutional architecture to specific managerial actions, investment choices, technological trajectories and socio-ecological effects. This composition defines the actual dynamics of bioeconomic recovery in the national economy, determining how quickly and irreversibly the transition from an extensive development model to an innovative bio-oriented one will occur.

In general, the motivational mechanism for the transition to the bioeconomic paradigm of economic recovery may have the following form [10; 13; 30; 64; 82]:

$$MM_{bio} = \left\{ N, I, M, S, \left(I_{inst.}^{formal} \cup I_{inst.}^{informal} \right), R \right\} \quad (1)$$

Where N – needs of recovery subjects;

I – economic, social, ecological and political interests of recovery subjects;

M – internal motives and value orientations;

S – system of external incentives;

$I_{inst.}^{formal} \cup I_{inst.}^{informal}$ – the set of formal and informal institutions that set the rules

of the game and restrictions for economic agents;

R – results that record actual shifts in the structure of reproduction (recovery, reconstruction) and development trajectory.

Such formalisation allows us to consider the motivational mechanism not as an auxiliary element of the management system, but as a structural and functional module that combines theoretical ideas about the driving forces of development with the practical architecture of institutions through which bioeconomic recovery is implemented in specific national conditions – Figure 1.

In the above composition, the fundamental theoretical and methodological coordinates are the neoclassical and Keynesian traditions, which interpret the motivation of economic agents in different but complementary ways. In the framework of neoclassical economic theory (A. Marshall [41], L. Walras [84], P. Samuelson [69], R. Solow [76]), the motivational mechanism is primarily associated with individual maximisation of utility and profit under conditions of limited resources, rational choice, and comparison of alternative benefits and costs. In the context of the bioeconomic paradigm for economic recovery in Ukraine, this means that the state, businesses, households, and territorial communities make decisions by comparing the expected results of traditional

(resource- and carbon-intensive) and bio-oriented development trajectories according to the criteria of profitability, risk, liquidity, and time preferences.

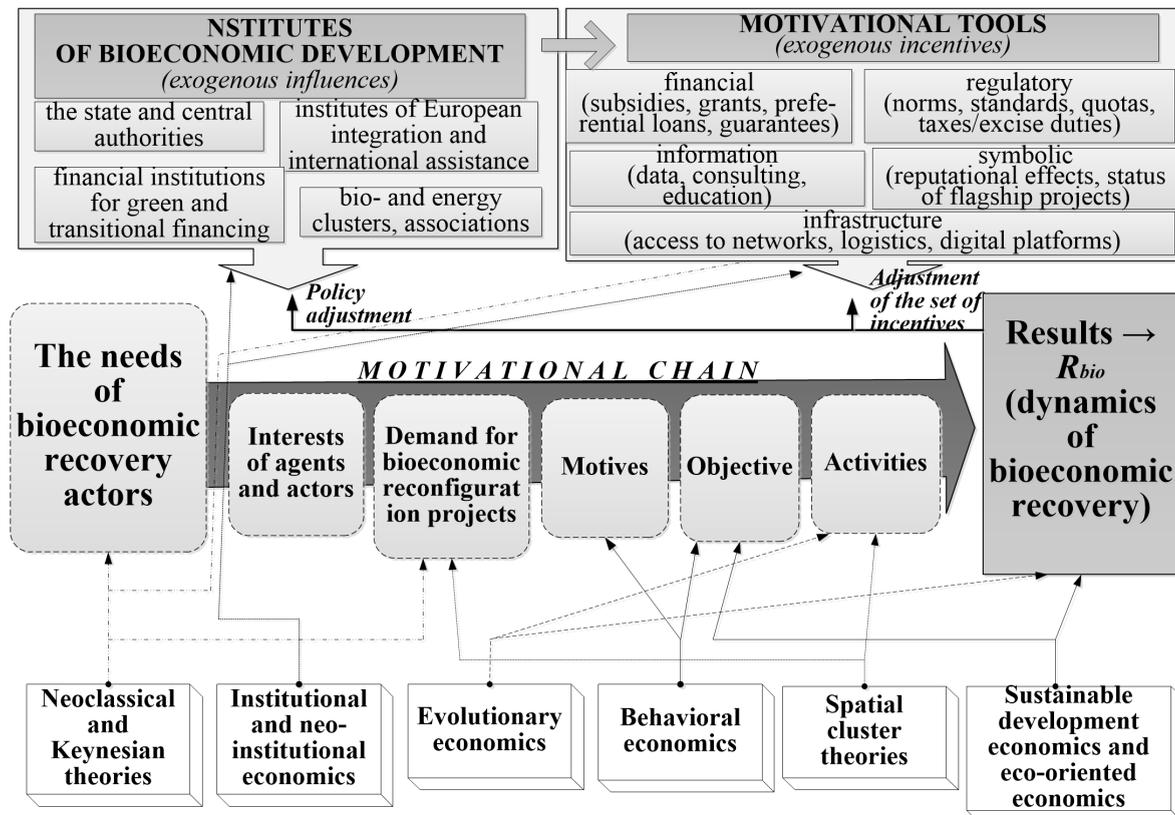


Figure 1. Visualisation of the essential content of the model of the motivational mechanism of bioeconomic recovery (reconstruction)

Source: compiled by the authors based on [6; 14; 38; 51; 50; 52]

Financial (monetary) incentives in the form of tax breaks, subsidies for bioenergy plants, grant support for organic waste processing, interest rate compensation, or priority access to credit resources act as channels for modifying the individual benefit function, under which the expected income $Y_i^{(bio)}$, resource savings, and reduction of regulatory and price risks for the i -th subject shift its “optimal” choice in favour of bioeconomic solutions.

The Keynesian tradition (J. M. Keynes [29], R. Harrod [17], E. Domar [9], further post-Keynesian and neo-Keynesian developments) complements this logic with the dimension of aggregate demand, fundamental uncertainty and “managed expectations”, emphasising the role of fiscal, debt and investment policies in shaping the motivational field. Under conditions of war and post-war uncertainty in Ukraine, not only the absolute value of stimulating flows becomes decisive, but also the stability of expectations regarding the long-term nature of state support for “green” investments, the predictability of access to EU financial and technical resources, the irreversibility of the course towards

European integration and the gradual achievement of climate neutrality. The configuration of expectations regarding future demand for bioproducts and “green” services formed in this way, the presence of institutionally established sales markets (including integration into the EU internal market), clear signals of budgetary, tax and debt policy, as well as transparent rules for selecting and supporting projects increase the propensity of economic agents to invest in long-term bioeconomic reconstruction projects, despite the high level of short-term risks and limited internal resources.

Institutional economic theory (D. North [46], O. Williamson [70], E. Ostrom [49], etc.) considers the essence and meaningful composition of the motivational mechanism in the plane of the “rules of the game”, which set the configuration of opportunities and restrictions for economic agents and determine the structure of incentives that accompany their choices. In Ukrainian realities, where formal and informal institutions coexist and often conflict with each other [53], the motivational mechanism for transition to a bioeconomy is formed at the intersection of three interconnected blocks [54–55; 65]:

The first block consists of formal institutions, which include legislation on renewable energy, waste management, environmental protection and climate policy, budget and tax regimes supporting bioprojects, standards for environmental and non-financial reporting, procedures for providing state aid and access to international financial instruments;

The second block represents informal institutions that manifest themselves in the level of environmental awareness of society, dominant values regarding the responsible use of natural capital, enshrined in the practices of interaction between business, communities and authorities, as well as in the degree of tolerance/intolerance to environmental violations, corruption practices and “shadow” schemes of resource use;

The third block comprises institutional agreements and organisations that materialise the rules of the game in specific organisational forms, such as bio- and energy clusters, industry associations, cooperatives, regional development agencies, recovery project offices, decarbonisation funds, and public-private partnerships.

In such an institutional perspective, the motivational effect appears not so much as a direct result of the action of a separate financial incentive, but as a consequence of the transformation of the structure of transaction costs and risks, i.e., a decrease in the costs of compliance with procedures and control, an increase in the predictability of regulation, a decrease in the probability of opportunistic behaviour of counterparties, an increase in the protection of property rights to bioresources and the results of biotechnological innovations, and a strengthening of trust in institutions. Through this channel, the institutional architecture determines how attractive bio-oriented strategies

become for different groups of economic agents and to what extent the bioeconomic paradigm gets a chance to be implemented, rather than remaining a purely normative construct. At the same time, the political and economic dimensions of institutional analysis reveal that the formation of the rules of the game occurs under the influence of competing coalitions of interests, including groups that derive rent from the preservation of carbon-intensive and raw material-export trajectories of development. In the absence of adequate safeguards, this creates risks of “capture” of the regulator and selective application of norms, which distorts the motivational field and weakens incentives for bio-oriented decisions. Hence, the requirement for the institutional design of the motivational mechanism, which should be based on minimising the possibility of extracting regulatory rent, ensuring transparency of decision-making and representativeness of participation of various stakeholder groups, to avoid a situation where bioeconomic policy is formally declared, but is actually used to reproduce outdated structural interests and the orthodox structure of sectors of the national economy.

Evolutionary economic theory (J. Schumpeter [71], R. Nelson [45], S. Winter [86], etc.) interprets the motivational mechanism as a system that forms a selection environment for stable technological and organisational ways of acting – established procedures, production practices and management rules – consolidating some development trajectories and marginalising others through a combination of reproduction, variation and selection processes. In the context of the bioeconomic recovery of Ukraine, where a significant array of production practices is historically oriented towards resource-intensive, energy-consuming and environmentally sensitive technologies, the configuration of the motivational mechanism determines which types of behaviour and technological solutions receive priority access to financial, informational, political and infrastructure resources, and which are gradually pushed to the periphery. With targeted design of incentives and institutions, selection pressure shifts in favour of projects related to bioenergy, agrobioprocessing, organic production, circular business models in waste management, resource-efficient and low-carbon construction, while practices that reproduce the “carbon” and raw material-export type of reproduction face deteriorating access to capital, increased regulatory requirements, and rising reputational risks.

Behavioral economics (H. Simon [8], D. Kahneman [26], A. Tversky [80], R. Thaler [79], etc.), in turn, emphasises the bounded rationality of subjects, the short time horizon of decision-making in conditions of war and high uncertainty, the effects of the status quo and loss aversion, and the low level of trust in formal institutions. This means that traditional economic incentives, constructed based on the assumption of a “fully rational” agent, may be insufficient if they are not accompanied by an appropriate “choice

architecture”. We are talking about simplified and transparent procedures for participating in support programs, built-in “by default” bio-oriented options in state, regional and corporate policies, transparent and accessible information about long-term benefits and risks, as well as symbolic motivators – reputational benefits, public recognition, inclusion in flagship reconstruction projects, which institutionally legitimise the social and professional significance of bioeconomic strategies. The combination of the evolutionary “selection environment” and the behavioural “choice architecture” makes the motivational mechanism capable not only of declaring, but also of actually changing, development trajectories in favour of the bioeconomy.

Spatial and cluster theories (A. Weber [85], W. Christaller [1], A. Lösch [77], M. Porter [68], P. Krugman [37], etc.) complement the essential and meaningful composition of the motivational mechanism with a territorial dimension, within which the structure of incentives and restrictions closely correlates with the characteristics of the location of economic activity. Bioeconomic recovery has a distinct spatial configuration, since the agrarian-oriented regions of Central Ukraine and the relatively safe rural territories of the South, which are not under temporary occupation, form the natural cores of agrobioenergy and bioprocessing clusters. In contrast, the deoccupied and border areas that have suffered the most significant destruction are considered priority pilot sites for the implementation of low-carbon technologies in construction, housing and communal services, and transport infrastructure. Industrial regions serve as a space for structural transformation from carbon-intensive to bio-oriented and resource-efficient production, characterised by a gradual shift in technological profile. At the same time, the temporary occupation of parts of the South and East of Ukraine by the Russian Federation creates additional spatial gaps and risks that must be taken into account in the design of motivational instruments and the definition of recovery priorities. In this perspective, the motivational mechanism functions as a system of spatially differentiated incentives, including variable tax and regulatory regimes, priority direction of infrastructure investments, specialised programs to support bioclusters, preferential conditions for territorial communities that are the first to introduce bio-oriented solutions in the areas of heat supply, water supply, waste management and urban transport, primarily in deoccupied and frontline regions. For clusters and territorial agglomerations, the key motivating factor is network and agglomeration effects, expressed through access to common innovation, logistics and digital infrastructure, expanded opportunities for cooperation in R&D, reduced individual transaction costs, collective participation in large international projects and support programs, which institutionally strengthen the attractiveness of bioeconomic strategies for local actors and contribute to the consolidation of relevant development trajectories at the regional and meso-level levels.

The generalisation of the outlined theoretical approaches allows us to consider the motivational mechanism for transition to the bioeconomic paradigm of economic recovery (reconstruction) in Ukrainian realities as a holistic systemic composition, within which the levels of needs, interests, motives, incentives, institutions and results are in a state of mutual dependence and constant feedback. At the level of needs, we are talking about the public demand for the recovery of destroyed infrastructure, reducing energy and raw material dependence, increasing food security, creating high-quality and sustainable jobs in the regions, minimising environmental and climate risks, in particular in view of the intensification of extreme weather events, as well as the growing demand for a fair distribution of environmental, economic, and social benefits and costs between different social groups and generations. At the level of interests, there is a need to coordinate the macro interests of the state (fiscal sustainability, ensuring defense capabilities, integration into the EU and NATO, fulfilling international climate obligations [66; 87; 89]), the meso interests of regions, clusters and territorial communities (attracting investments, retaining and returning the population, forming new competitive niches based on bioresources [31; 35; 56]) and the micro interests of business and households (stable income, employment, acceptable level of risk, improving the quality of life [24; 27; 60]). In this area, the problem of inclusiveness of the bioeconomic transition arises, in which the motivational mechanism should not only encourage investments in bio-oriented sectors, but also take into account the interests of workers in “traditional” (orthodox) industries, small businesses, and internally displaced persons, preventing the concentration of benefits in narrow groups of elites and the strengthening of social polarisation.

At the level of motives, we are talking about forming an internal readiness to transition from the “survival economy” model to the “recovery economy” model, in which bio-oriented solutions are perceived not as an additional regulatory or financial burden, but as a tool for reducing long-term risks, diversifying sources of income and expanding growth opportunities in the medium and long term.

At the level of incentives, an orderly system of financial, regulatory, infrastructural, informational, and symbolic instruments is being formed that sets the “route” for the transition to the bioeconomy and sends clear signals to subjects regarding desired and undesirable behavioural trajectories. At the level of institutions, this involves building a coordinated architecture of formal and informal rules of the game, organisations, and agreements capable of ensuring transparency, predictability, inclusiveness, and accountability in recovery processes for different groups of stakeholders, particularly in conditions of war and post-war risks.

At the level of results, the motivational mechanism manifests itself through the fixation of actual structural shifts in the direction of the bioeconomic growth model, in particular, an increase in the share of bioenergy and bioproducts in the structure of production and consumption, an expansion of organic waste processing and a decrease in the share of its landfilling, increased resource efficiency, a decrease in the carbon intensity of GDP, the recovery and preservation of ecosystems, and an improvement in the quality of life in communities, especially de-occupied and frontline ones.

In this context, the social legitimacy of bioeconomic transformations directly depends on whether different population groups perceive the transition as fair and one that expands their opportunities, rather than narrows them through a one-sided concentration of benefits and shifting of costs. In a simplified form, the specified system logic can be represented as a functional dependence:

$$R_{bio} = F\left(N, I, M, S, \left(\begin{matrix} I_{formal} \\ inst. \end{matrix} \cup \begin{matrix} I_{informal} \\ inst. \end{matrix} \right) \middle| \text{war and post -} \right. \quad (2)$$

war conditions of Ukraine, restrictions due to European integration

Where the results of bioeconomic reconstruction R_{bio} are a function of needs N , interests I , motives M , incentives S and institutions $\left(\begin{matrix} I_{formal} \\ inst. \end{matrix} \cup \begin{matrix} I_{informal} \\ inst. \end{matrix} \right)$, determined by the specifics of the Ukrainian war and post-war context and the requirements of integration into the European economic and legal space.

Such a statement of the problem brings to the fore the block $\left(\begin{matrix} I_{formal} \\ inst. \end{matrix} \cup \begin{matrix} I_{informal} \\ inst. \end{matrix} \right)$ – as the structural and semantic core of the motivational mechanism, which mediates the transition from abstract determinants to concrete tools and practices. Accordingly, further analysis should focus on revealing the architecture of the institutes of the motivational mechanism of economic recovery, taking into account the principles on which the bioeconomy is built.

Chapter 2. The architecture of institutes of the motivational mechanism of economic recovery (reconstruction) based on the principles of bioeconomy

In the process of post-war economic reconfiguration in Ukraine, not only is the availability of relevant determinants and policy instruments of key importance, but also the way in which they are institutionally fixed and translated (through transmission channels) into motivational signals for economic entities, territorial communities, and households. The institutional

dimension determines which incentives become effective, which remain declarative, and which generate undesirable side effects. In this context, the architecture of institutes that drives the motivational mechanism of economic recovery based on bioeconomy appears as an ordered configuration of formal and informal rules, organisational structures, and institutional agreements that set the parameters of the motivational field for economic agents in war and post-war conditions. It covers not only the list of authorities, business entities, or their associations, but also the methods of their systemic interaction, coordination formats, distribution of powers and responsibilities, mechanisms of accountability, and the inclusion of stakeholders, which determine whether bio-oriented recovery trajectories will be perceived as realistic and attractive to various stakeholders.

In this context, it is advisable to single out a specific institute as part of the motivational mechanism for economic recovery – an organisational form of interaction between “actors” (initiators and leaders of recovery policy) and “agents” (carriers of economic activity on the ground) through a system of institutions and motivators. This institute accumulates norms, programs, plans, procedures and resources that regulate and direct the process of stimulating subjects to participate in bioeconomic practices, and thereby performs the function of a nodal element in the architecture of institutes, which ensures the coordination of strategic recovery goals with specific instruments of influence on the behaviour of stakeholders.

Taking into account the adopted composition of the motivational mechanism (MM_{bio}), it is advisable to present the institutional block as a three-dimensional structure combining [25; 43–44; 53; 57]:

Firstly, vertical levels (macro-, meso- and micro-levels of the economic system), which reflect different scales of formation and implementation of motivational influences. Thus, at the macro level, strategic goals and nationwide “rules of the game” are set, at the meso level, they are specified in sectoral-regional programs and clusters, at the micro level, they are implemented in the practices of enterprises, households, and public organisations;

Secondly, functional subsystems (regulatory, financial and budgetary, information and analytical, coordination and partnership, control, innovation and knowledge, social and protective), each of which is responsible for a specific channel for the formation of incentives and restrictions, i.e. the development of norms and standards for the mobilisation of financial resources, the generation and dissemination of knowledge, the organisation of partnerships and the provision of social support in the transition process;

Thirdly, types of institutions (formal and informal, state, market, public, and mixed) determine the nature of the consolidation of motivational signals

through legally binding norms, organisational procedures, and contracts, or through cultural codes, value systems, and informal interaction practices.

In a compact form, we can represent the architecture of the institutes of the motivational mechanism as follows [11; 34; 40; 65; 88]:

$$\begin{aligned}
 Inst_{bio} = & \left(Inst^{macro} \cup Inst^{meso} \cup Inst^{micro} \right) \times \\
 & \times \left(Inst^{reg} \cup Inst^{fin} \cup Inst^{info} \cup Inst^{partner} \cup Inst^{contr} \cup Inst^{innov} \cup Inst^{soc} \right) \times \quad (3) \\
 & \times \left(Inst^{form} \cup Inst^{inform} \right)
 \end{aligned}$$

Where $Inst^{macro} \cup Inst^{meso} \cup Inst^{micro}$ – sets of institutes at the macro-, meso- and micro-levels, respectively;

$Inst^{reg} \cup Inst^{fin} \cup Inst^{info} \cup Inst^{partner} \cup Inst^{contr} \cup Inst^{innov} \cup Inst^{soc}$ – subsystems of regulatory, financial, information-analytical, coordination-partnership, control, innovation-knowledge and social-protection institutes;

$Inst^{form} \cup Inst^{inform}$ – sets of formal and informal institutions.

This formalisation captures the architecture of $Inst_{bio}$ as an institutional and structural space within which motivational incentives and constraints are configured, directing the behaviour of stakeholders towards bio-oriented solutions (Figure 2).

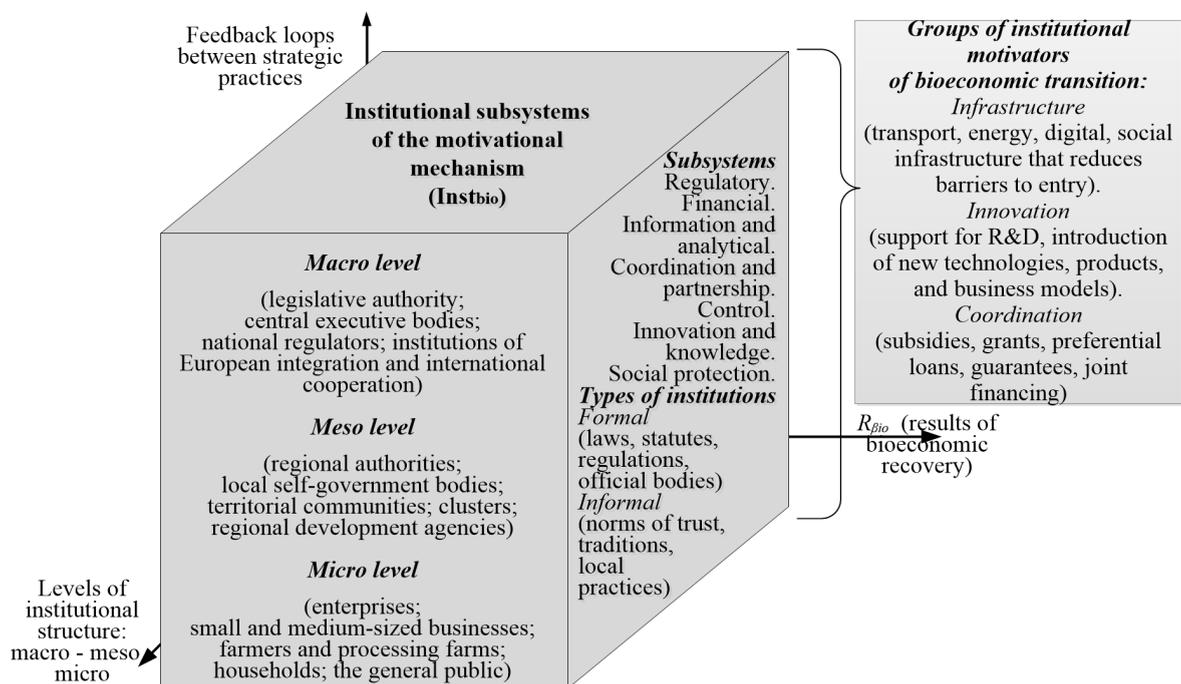


Figure 2. “Institutional cube” of the motivational mechanism of bioeconomic recovery (reconstruction)

Source: compiled by the authors based on [5; 12; 16; 22; 75]

At the macro level, the architecture of institutes is formed, first and foremost, by those institutions that set the strategic and regulatory framework for economic recovery and bioeconomic transformation. In particular, these are legislative bodies, central executive bodies and national regulators that form the hierarchy of legal norms and strategic documents in the areas of budget and fiscal, debt, environmental, agricultural, energy, regional, innovation and scientific and technological policy, as well as institutes of European integration and international cooperation through which Ukraine's obligations under the EU's "green" course, climate agreements and post-war support programs are implemented. At this level, the basic parameters of the motivational environment are determined, i.e. the goals of decarbonisation and bioeconomy development are fixed, the priorities for recovery and structural restructuring of the economy are outlined, the rules for access to budgetary resources, international financial assistance and specialised EU instruments are established, general requirements for environmental, climate and non-financial reporting are set, and ESG framework standards are formed. Macro-institutes serve as institutional mechanisms for ensuring strategic commitments, setting long-term guidelines and expectations regarding the irreversibility of the bioeconomy course, generating signals about priority investment, technological and spatial trajectories, and also determining the principles of sharing risks and adaptation costs between the state, business and households, including the intergenerational dimension of these risks and benefits.

At the meso-level, the architecture of institutes is an institutional superstructure over specific sectors and territories, within which national priorities take the form of regional and sectoral policies. The circle of such institutes includes regional state authorities, local governments and their executive structures, territorial communities, sectoral and inter-sectoral clusters, professional and business associations, cooperative associations, regional development agencies, recovery project offices, local initiative support funds and regional decarbonisation funds [51; 81]. Collectively, they serve as institutional mechanisms for translating national strategies and regulatory frameworks into specific programs, projects, and instruments adapted to the local structure of needs, resource base, environmental constraints, and socio-economic risks. At this level, key incentives for economic actors are formed, i.e. regional programs to support bioenergy and bioprocessing, local projects to modernise heat supply, water supply, and waste management systems on a bio-oriented basis, special regimes for clusters, local tax instruments, land policy instruments, and spatial planning and zoning regulations.

Within the framework of regional policy, it is advisable to institutionalise the so-called "growth points" – priority areas aimed at addressing systemic problems in the development of territories (including de-occupied and frontline regions), with a wide spatial coverage and a long-term implementation horizon.

Around such “growth points” are structured basic groups of institutional motivators for bioeconomic recovery – infrastructure, innovation, and investment – which, in various combinations, form attractive conditions for regional actors and agents to participate in bio-oriented projects. An essential function of meso-institutes is the organisation and support of partnerships between business, territorial communities, scientific and educational institutions, which reduces the transaction costs of cooperation, facilitates access to external financing, technical assistance and expertise, and also creates conditions for the formation of network and cluster effects, which are critically important for the scaling of bioeconomic practices [47; 51].

At the micro level, the architecture of institutes represents the dimension in which the bioeconomic transition is “rooted” in the everyday practices of economic actors. This level includes institutes directly related to the carriers of bioeconomic practices, such as real sector enterprises, agricultural and food processing enterprises, small and medium-sized businesses, households, public organisations, and initiative groups, as well as scientific and educational organisations that implement biotechnological, circular, and resource-efficient solutions. In this dimension, institutes take the form of rules and procedures recorded in corporate charters, internal regulations, collective agreements, ethical and environmental codes, quality and safety management standards, as well as local unwritten norms of interaction in labour and territorial collectives. It is the level where corporate governance institutes, internal systems of motivation and personnel evaluation, corporate social responsibility and ESG policies, quality and environmental responsibility standards, professional training and advanced training practices, as well as local forms of mutual aid and self-organisation in communities, are implemented. At this level, external incentives are translated into specific investment, production and consumer decisions, established decision-making rules and behavioural patterns are formed, which either consolidate bio-oriented models (through the choice of appropriate technologies, products, methods of consumption and labour organisation) or, conversely, reproduce inertial, high-carbon and resource-intensive practices, undermining the effectiveness of macro- and meso-level policies of bioeconomic recovery.

An essential component of the architecture of institutes is informal institutes that determine the deep parameters of the motivational field and often turn out to be no less influential than formally established norms. These include norms of trust, justice, mutual responsibility, a culture of attitude towards natural capital, established traditions of farming, dominant ideas about successful economic strategies, acceptable forms of risk-taking and permissible limits on the use of common resources. In rural areas and small towns, these institutes are manifested through daily practices of interaction between neighbours and local elites, the nature of local leadership, the level of tolerance for corruption

and shadow schemes, attitudes towards violations of environmental norms, as well as through traditional models of land use, water use and waste management. In war and post-war conditions, new forms of horizontal solidarity are introduced, including volunteer networks, initiative groups to support internally displaced persons, and practices of community self-organisation in matters of reconstruction, energy, and food security, which establish new standards of mutual assistance and responsibility. On the one hand, such informal institutes can become a powerful channel for legitimising bioeconomic approaches if they are consistent with local ideas about justice, the common good and an acceptable distribution of costs and benefits. On the other hand, if economic agents perceive the bioeconomic transition as unfair, too asymmetric or imposed “from above”, then the same informal institutional layer can generate persistent resistance, blocking the implementation of formal norms, increasing the transaction costs of politics and reproducing the trajectory inertia of traditional, resource- and carbon-intensive development models.

The political and economic dimension of the architecture of institutes is that the motivational mechanism is formed not by an “abstract” state, but as a result of the interaction and confrontation of interest coalitions enshrined in the relevant institutional structures. Some of them are structurally interested in promoting the bioeconomic trajectory of development – these are environmentally oriented businesses, segments of the agricultural sector that invest in bioenergy and bioprocessing, innovatively active industrial enterprises, scientific, expert and environmental communities, and some territorial communities that see the bioeconomy as a chance for long-term modernisation and increased sustainability. Other coalitions receive economic and political rent from the preservation of the fossil-based raw material model. These include traditional fuel and energy complexes, raw material export groups, financial and industrial interests associated with them, and corruption networks in the areas of land, resource and infrastructure relations. In the absence of proper institutional safeguards, the architecture of institutes can be distorted through rent-seeking and regulatory capture, the selective application of norms, and the use of regulatory procedures to block changes undesirable to some groups. This creates situations where “green” policies are declared in strategic documents, but in practice, the dominant high-carbon and resource-intensive development trajectories are reproduced [2; 4; 7; 61]. This leads to a key requirement for the institutional design of the motivational mechanism, which involves minimising the possibility of extracting regulatory rent and manipulating norms, ensuring transparency and accountability of decision-making processes, openness of data on financial flows and the results of the implementation of bioeconomic programs, the availability of effective procedures for external and public control, as well as representative

participation of various stakeholder groups in policy development and correction.

In the theoretical and methodological dimension of justice [28] and inclusiveness [48; 67] of the bioeconomic transition, the architecture of the institutes of the motivational mechanism should ensure not only economic efficiency and achievement of target indicators, but also social acceptability, a sense of procedural and distributive justice, and therefore the legitimacy of structural shifts in the perception of different groups of stakeholders. This means that the redistribution of benefits and costs between sectors, territories, and social groups inevitably accompanies changes in the technological and spatial structure of the economy. Thus, institutes should ensure a format for this redistribution that minimises social tension and barriers to making bioeconomic decisions. This involves the development and real filling of institutes of social dialogue, collective bargaining, tripartite and multilateral formats (state – business – business associations – territorial communities), the creation of working mechanisms for retraining and employment support for workers who potentially lose their jobs as a result of decarbonisation, closure or transformation of traditional industries, the implementation of targeted programs to support vulnerable groups of the population and territories that face the most significant adaptation costs. Through these channels, the institutional architecture directly determines whether the bioeconomic transition will be perceived as a fair and predictable process or, on the contrary, as a source of losses and threats, and therefore whether the formally proposed incentives will be transformed into sustainable motivational attitudes of subjects to support and recreate a new development trajectory.

In the functional dimension, it is advisable to distinguish several key institutional subsystems of the motivational mechanism, each of which is responsible for a specific channel through which incentives, restrictions, and expectations are formed among economic entities (Figure 3).

The regulatory subsystem encompasses bodies and procedures that form and ensure the application of legal norms, standards, and requirements (environmental, energy, agricultural, construction, climate, etc.), setting a “corridor” of permitted, undesirable, and priority behaviours. Through a system of laws, bylaws, technical regulations, licensing, and permitting procedures, it determines the minimum permissible level of environmental and resource efficiency, stimulates the transition to low-carbon technologies, and, at the same time, establishes sanctions for violations of established rules.

The financial subsystem unites budgets of different levels, state and municipal funds, development banks, guarantee institutions, as well as mechanisms of “green” and transitional financing, through which motivational impulses are translated into specific resource flows. This subsystem implements subsidies, grants, soft loans, fiscal benefits, and compensations, as

well as risk-sharing instruments between the state and private investors, which determine the financial attractiveness of bioeconomic solutions compared to traditional alternatives.

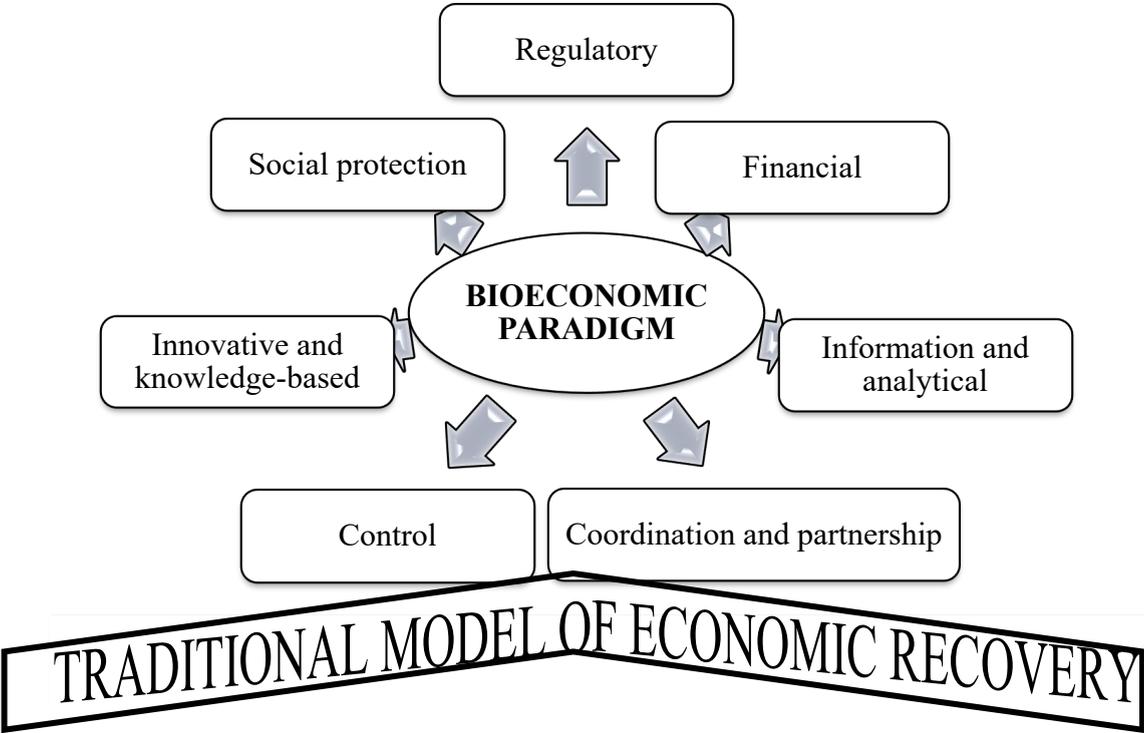


Figure 3. Institutional subsystems of the motivational mechanism of the bioeconomic “breakdown” of the traditional model of economic recovery

Source: compiled by the authors based on [15; 23; 36; 72–74]

The information and analytical subsystem includes statistical services, greenhouse gas emission monitoring and verification systems, bioresource cadastres, digital open data platforms, analytical centres and expert structures that ensure transparency of the consequences of bioeconomic solutions, form a basis for comparing development scenarios and create a basis for rational expectations of subjects regarding the risks and benefits of the bioeconomic transition.

The coordination and partnership subsystem encompasses clusters, public-private partnership networks, innovation hubs, advisory boards, and cross-sectoral interaction platforms, through which the actions of various stakeholders are coordinated, and network and agglomeration effects are fostered. It reduces the transaction costs of finding partners, coordinating interests, and jointly implementing projects, facilitates access to external

sources of financing, technologies, and knowledge, thereby increasing the motivation to participate in bioeconomy initiatives.

The control subsystem includes institutes for environmental, financial, and anti-corruption control and audit, as well as judicial and quasi-judicial mechanisms for the protection of rights. Its components ensure compliance with established rules, minimise opportunistic behaviour, reduce the risks of abuse, and thereby strengthen trust in recovery policies and incentive instruments.

The innovation and knowledge subsystem comprises research institutions, universities, technology transfer centres, advisory services, and professional educational platforms that generate, adapt, and disseminate knowledge critical for the bioeconomy development. Through applied research programs, pilot projects, experimental sites, and a system of training and retraining of personnel, it forms the human and technological basis of the transition.

The social protection subsystem encompasses institutes of social protection, the labour market, education, and healthcare, as well as income and employment support mechanisms that provide a “safety cushion” for households and workers during the process of structural change. It reduces social barriers to making bio-oriented decisions, mitigates short-term losses for individual groups and territories, and thereby increases the sustainability of public support for the bioeconomic transition.

Within the framework of these subsystems, it is advisable to distinguish at least three key groups of institutional motivators for the bioeconomic transition: infrastructure, innovation, and investment. Infrastructure motivators are associated with the creation and modernisation of transport, energy, digital and social infrastructure, which reduces the barriers to entry into bio-oriented activities. Innovation motivators take the form of supporting the implementation of new technologies, products and organisational solutions that ensure increased resource efficiency and reduced carbon intensity. Investment motivators encompass specific financial instruments, including preferential lending, grants, guarantee mechanisms, and joint financing, which alter the risk-reward ratio in favour of bioeconomic projects. Their interaction with institutional subsystems of different levels is shown in Figure 2.

Taken together, the outlined levels, types, and functional subsystems form a holistic architecture of the motivational mechanism’s institutes, within which individual and collective decisions of stakeholders are consistent (or inconsistent) with the long-term goals of bioeconomic reconfiguration of the economy.

The degree of integrity, internal coherence, transparency, inclusiveness, and adaptability of this architecture determines whether the bioeconomic paradigm will remain primarily a normative construct in strategic documents or transform into a sustainable trajectory of post-war development, supported by real

investment, technological, and behavioural shifts. Therefore, a methodologically significant task arises – not only to describe the institutional configuration of the motivational mechanism, but also to develop a toolkit for its quantitative and qualitative diagnostics, i.e. criteria for integrity and coherence, a system of indicators of effectiveness and sustainability, and approaches to measuring the impact of institutional parameters on motivational attitudes and behaviour of subjects. Such a toolkit should be based on a systemic approach that combines genetic, structural-functional, reproductive, process, synergistic and institutional analysis, allowing to take into account the origin and evolution of institutes simultaneously, their role in the reproductive circuits of the economy, the dynamics of subsystem interaction and the effects of mutual reinforcement or blocking of motivating influences. This, in turn, necessitates the development of a holistic and applied methodology for assessing the architecture of the motivational mechanism of economic recovery based on bioeconomy, capable of quantitatively and qualitatively recording its state, dynamics, and impact on the behaviour of stakeholders.

Chapter 3. Methodology and techniques for assessing the architecture of the motivational mechanism of economic recovery (reconstruction) based on the principles of bioeconomy

The methodology for assessing the architecture of the motivational mechanism of bioeconomic recovery is based on the formalised compositions MM_{bio} and $Inst_{bio}$ as a kind of ontological “framework” of the system, within which motivation appears not only as a psychological characteristic of individuals, but as an institutionally mediated economic category. According to this vision, the motivational mechanism serves as an intermediate link between the structure and agents, between the objective determinants of restoration (needs, interests, resource and environmental constraints, institutional norms [58; 83]) and subjective expectations, notions of justice and acceptable development trajectories, which ultimately materialise in the results of R_{bio} .

From the standpoint of the system approach [18–19], which integrates genetic, structural-functional, reproductive, process, synergistic, institutional and behavioural analysis, the architecture of the motivational mechanism is considered as a multi-level institutional construction with its own internal logic of evolution, configuration of incentives and restrictions, which sets the field of possible and probable actions of economic agents in war and post-war conditions. Accordingly, the techniques for its assessment should be able to:

Firstly, diagnose the state and degree of coherence of key institutional blocks with the teleology of bioeconomic reconfiguration;

Secondly, identify structural imbalances, institutional gaps and “bottlenecks” in the configuration of motivating influences;

Thirdly, to provide quantitative and qualitative measurement of the contribution of individual groups of institutional motivators to achieving target results R_{bio} at different levels of the economic system, that is, to translate latent motivational processes into the space of formalised indicators and comparative analytics.

The generalisation of the approaches presented in the studies of motivational mechanisms of socio-economic development [21; 23; 39; 63] allows us to build a three-level logic of analysis adapted to the tasks of the post-war bioeconomic transformation of Ukraine. In methodological terms, we are referring to the sequential implementation of three interconnected stages that together form the cycle of “observation – interpretation – evaluation” of the architecture of the motivational mechanism within the $Inst_{bio}$ and its impact on the results of R_{bio} .

The first, monitoring stage, focuses on correcting the actual state of the institutes within the motivational mechanism. At this stage, the presence/absence of key elements in the structure of $Inst_{bio}$, the degree of their institutional maturity (from embryonic forms to established practices), the level of formalisation and coherence with the declared strategic goals of bioeconomic recovery are revealed. In addition, at this stage, an “institutional cross-section” of the system is formed through correspondence matrices, maps of institutional coverage by levels (macro, meso, micro) and functional subsystems.

The second, analytical stage is interpretive in nature. It aims to identify the causes of institutional gaps, barriers, and asymmetries, as well as to position individual institutes in their life cycle. For this purpose, a typology of stages of institutional development is used (emergence, institutionalisation, diffusion, stagnation, crisis, re-institutionalisation), taking into account the specifics of the Ukrainian war and post-war conditions, when “young” and “outdated” institutional forms can coexist simultaneously within the same policy field. At this stage, the cause-and-effect relationships between the parameters of $Inst_{bio}$ and the motivational settings of the subjects are reconstructed, “bottlenecks” in the configuration of incentives and constraints, as well as zones of institutional redundancy and, conversely, institutional vacuum are identified.

The third evaluation stage focuses on measuring the effectiveness of the motivational mechanism’s architecture. It establishes the extent to which institutional motivators of various types (infrastructure, innovation, investment, information, social, etc.) actually ensure the achievement of the target benchmarks of bioeconomic recovery and generate the desired changes of R_{bio} . This stage involves the formation of aggregated and partial

performance indicators, the calculation of indices measuring the influence of individual groups of institutions on the dynamics of bioeconomic indicators, and the comparison of regions and clusters based on the degree of compliance of their institutional configurations with the requirements of the bioeconomic paradigm. This sequence enables the integration of the diagnostic, explanatory, and evaluative functions of the techniques into a unified analytical framework.

The key methodological step that ensures the transition from a qualitative description of the institutional architecture of the motivational mechanism to its analytical and quantitative understanding is the construction of a system of indices that aggregate information about the state of processes, institutions and institutional relations within the $Inst_{bio}$ composition. Given the proposed three-level logic of assessment (monitoring, analytical and evaluation stages), each of these stages is “responsible” for its own layer of data. In particular, the monitoring stage fixes the structural and functional presence as well as the basic parameters of institutions. The analytical stage reconstructs the configuration of institutional interactions and stages of the life cycle of institutes. In contrast, the evaluation stage transforms the accumulated information into integral indicators of the ability of institutional motivators to generate the desired changes in the results of R_{bio} .

For each n -th institutional motivator of bioeconomic recovery (infrastructure, innovation, investment, etc.) at the g -th level of analysis (country, region, territorial community, cluster, enterprise), it is advisable to introduce an integral index of institutional capacity $I_{MM}^{(g,n)}$, which summarises three groups of indicators:

- the first, characterises the object or process $I_{obj}^{(g,n)}$. ;
- the second, characterises the institution $I_{inst}^{(g,n)}$;
- the third, characterises institutional relations between stakeholders $I_{rel}^{(g,n)}$.

Generalising the formulation used in classical models for evaluating the motivational mechanisms of development (recovery, reconstruction), the integral index can be presented as follows:

$$I_{MM}^{(g,n)} = \alpha_n I_{obj}^{(g,n)} + \beta_n I_{inst}^{(g,n)} + \gamma_n I_{rel}^{(g,n)}, \quad \alpha_n, \beta_n, \gamma_n \geq 0, \quad \alpha_n + \beta_n + \gamma_n = 1 \quad (4)$$

Where, the weight coefficients $\alpha_n, \beta_n, \gamma_n$ reflect the relative importance of the “object”, institutional and relational components for a specific institutional motivator n (for example, for the infrastructure block $I_{obj}^{(g,n)}$ acquires greater weight, for the innovation one – $I_{inst}^{(g,n)}$, for the investment one – $I_{rel}^{(g,n)}$).

In this configuration, the monitoring stage provides measurement of baseline indicators and formation of $I_{obj}^{(g,n)}$; the analytical stage assesses the parameters

of institutions and their evolutionary status $I_{inst}^{(g,n)}$ and the structure of interaction between stakeholders $I_{rel}^{(g,n)}$; the evaluation stage aggregates these components into an integral index $I_{MM}^{(g,n)}$ and links it to the dynamics of R_{bio} results.

Formally, the evaluation cycle for each level g can be interpreted as:

$$E^{(g)}: Inst_{bio}^{(g)} \cdot \{I_{obj}^{(g,n)}, I_{inst}^{(g,n)}, I_{rel}^{(g,n)}\} n \cdot \{I_{MM}^{(g,n)}\} n \cdot R_{bio}^{(g)} \quad (5)$$

This cycle reflects a sequential transition from a qualitatively described architecture of institutes to a system of formalised indicators, and ultimately, to an assessment of the contribution of individual institutional motivators to the formation of the results of bioeconomic recovery at the macro-, meso- and micro-levels. Thus, $Inst_{bio}$ acts as an “input space” of institutional parameters, the set of indices $\{I_{obj}^{(g,n)}, I_{inst}^{(g,n)}, I_{rel}^{(g,n)}\}$ is an intermediate plane of observed characteristics, $I_{MM}^{(g,n)}$ is an aggregated reflection of the capacity of specific motivators, and $R_{bio}^{(g)}$ is a performance projection of this institutionally motivated process.

In practical terms, filling the integral index $I_{MM}^{(g,n)}$ with content requires the specification of a system of indicators for each type of institutional motivators. For the infrastructural institutional motivator at the object/process level $I_{obj}^{(g,n)}$, it is advisable to use indicators of the actual state and availability of basic infrastructure for bioeconomic practices. Such indicators can include the share of households and enterprises connected to heating systems using biofuels, the share of communities that have introduced separate collection of organic waste, the length and quality of transport infrastructure that provides logistics for biowaste materials, and the level of digital coverage (broadband Internet, digital resource management platforms). The component $I_{inst}^{(g,n)}$ in this case may include indicators of the availability and quality of profile strategic documents (heating schemes, sustainable urban mobility plans, regional waste management plans), the degree of their regulatory consolidation, the stability of financing of relevant programs, and the institutional capacity of bodies responsible for planning and operating infrastructure. The component of institutional relations $I_{rel}^{(g,n)}$ will reflect the nature of stakeholder interaction, i.e. the availability and effectiveness of coordination mechanisms between authorities, infrastructure operators, business and communities; the prevalence of public-private partnerships; the level of public participation in planning infrastructure projects; indices of trust in infrastructure operators and authorities.

For an innovative institutional motivator, the object/process component $I_{obj}^{(g,n)}$ can characterise the intensity and effectiveness of bioeconomic innovations, expressed in terms of the share of R&D expenditures in GDP/GRP or in the revenue of enterprises in the relevant sector; the number of implemented biotechnological, circular and low-carbon solutions; the number of patents, utility model applications, startups in the bioeconomy; the share of enterprises implementing environmental and resource-efficient innovations. The component $I_{inst}^{(g,n)}$ will describe the degree of institutionalisation of innovation support, in particular the presence and development of a network of research institutions, universities, technology transfer centres, innovation hubs and clusters; the number and scale of grant support programs for research and development; the stability of financing for applied research in the bioeconomy; the presence of regulatory regimes that facilitate the experimental implementation of technologies (pilot zones, innovative regulatory regimes). The component $I_{rel}^{(g,n)}$ will capture the density and quality of creative interactions, which is expressed through the number of joint projects “university – business – community”, the participation of a region or cluster in international research programs, the intensity of horizontal connections between enterprises (joint laboratories, consortia), the level of inclusion of local actors in national and international innovation networks.

For the investment institutional motivator, the object component $I_{obj}^{(g,n)}$ will reflect the scale and structure of actual financial flows into bioeconomic recovery – the volume of investments in bioenergy, agrobioprocessing, circular solutions in housing and communal services and construction per capita or as a share of GDP/GRP/budgetary expenditures (in terms of general and special funds); the share of “green” and transitional financial instruments in the total volume of financing; the share of long-term capital in the structure of investment resources. The component $I_{inst}^{(g,n)}$ in this case will cover the characteristics of investment support institutions – the presence of specialised funds (decarbonisation funds, regional development funds), investment guarantee and insurance institutions, regional or sectoral co-financing programs, the degree of predictability and transparency of the rules for access to these instruments, the compliance of the national regulatory framework with the principles of “green” financing. The component of institutional relations $I_{rel}^{(g,n)}$ will characterise the configuration of interactions between investors, state authorities, communities and financial intermediaries – the share of projects implemented in public-private partnership formats; the prevalence of joint investment mechanisms with the participation of international financial organisations; the presence of public consultation procedures for the selection

of investment projects; the level of conflict or, conversely, consistency between the interests of local stakeholders and investors.

In this way, for each type of institutional motivator, a three-component set of indicators $\{I_{obj}^{(g,n)}, I_{inst}^{(g,n)}, I_{rel}^{(g,n)}\}$ is formed, which, on the one hand, preserves a single methodological logic for constructing the integral index $I_{MM}^{(g,n)}$, and on the other hand, allows taking into account the specifics of different areas of bioeconomic restoration and adapting the assessment system to the characteristics of the national socio-economic and institutional environment of Ukraine at the macro-, meso- and micro-levels.

Taking into account that the architecture of $Inst_{bio}$ includes three basic groups of institutional motivators (infrastructural, innovative and investment), the integral assessment of the institutional capacity of the motivational mechanism at level g can be presented as a weighted sum of the indices of the corresponding blocks:

$$I_{Inst}^{(g)} = (w_{infr} \times I_{MM}^{(g, infr)}) + (w_{innov} \times I_{MM}^{(g, innov)}) + (w_{invest} \times I_{MM}^{(g, invest)}) \quad (6)$$

Where, $I_{Inst}^{(g)}$ – integral index of the institutional capacity of the motivational mechanism of bioeconomic recovery at level g ; $I_{MM}^{(g, infr)}$, $I_{MM}^{(g, innov)}$, $I_{MM}^{(g, invest)}$ – integral indices of the corresponding institutional blocks; w_{infr} , w_{innov} , w_{invest} – blocks' weights reflecting the relative priority of infrastructural, innovative and investment motivators at a certain stage of recovery, with $w_{infr} + w_{innov} + w_{invest} = 1$. In the simplest case, the weights can be considered equal; more advanced modifications of the techniques involve the use of expert scaling or the empirical determination of weights based on econometric models of the relationship between institutional blocks and the R_{bio} results.

A vital component of the techniques is the assessment of not only the current state of institutes, but also the stage of their life cycle, that is, the phase of evolution in which the corresponding institutional structure is located in the coordinates of the indices $I^{inst}, I^{obj}, I^{rel}$ (Figure 4). This approach allows us to move from a static “slice” to a dynamic analysis of institutional changes, recording whether the institute is in the phase of emergence, deployment, stabilisation or, conversely, degradation and replacement. For the war and post-war conditions in Ukraine, it is advisable to distinguish at least six typical stages in the evolution of bioeconomic recovery institutes.

As can be seen from Figure 4, the phase-index trajectory of the life cycle of the bioeconomic recovery institute reflects not only the change in its formal status, but also the evolution of the ratio of three key components – the object/process state index (I^{obj}), the institutional design index (I^{inst}) and the institutional relations index (I^{rel}) over time. In the initial phase of emergence,

all three indices are at low level, which indicates the existence of the institute primarily in the form of discourse and individual initiatives, without a developed regulatory framework or stabilised practices of stakeholder interaction. In the institutionalisation phase, the graph of I^{inst} is ahead of I^{obj} and I^{rel} , demonstrating a typical situation for transitional economies, when legal norms, authorities and procedures are formed faster than the material and technical base, and day-to-day practices are updated; accordingly, the growth of I^{obj} and I^{rel} is inertial and occurs with a time lag. The subsequent transition to the diffusion stage is characterised by an accelerated increase in I^{obj} and I^{rel} under conditions of relatively slower growth of I^{inst} : the institute, which was “written on paper”, begins to be massively reproduced in the form of specific projects, technological solutions and cooperation formats, cluster and network effects are strengthened, and transaction costs of coordination are reduced. At the stabilisation stage, all three indices reach a relatively high and stable value, which reflects the institute’s rooting in the institutional environment. At the same time, the slowdown in the growth of the indices signals the accumulation of hidden dysfunctions, primarily bureaucratisation and loss of adaptive capacity. The stagnation/crisis stage is visualised through the divergence of trajectories: I^{inst} remains at a high level, while I^{obj} and I^{rel} decrease or stagnate, indicating a gap between the formal normative construction and the real practice of using the institute, as well as the erosion of trust and the growth of opportunism. Finally, the re-institutionalisation phase reflects a transition to a new trajectory: a temporary decrease in I^{inst} associated with the dismantling of outdated institutional forms, in the case of a successful reform, is accompanied by a further increase in I^{obj} and I^{rel} , when the updated architecture ensures the recovery of practical capacity and an increase in the quality of stakeholder interaction. Thus, Figure 4 visually demonstrates that the life cycle of bioeconomic recovery institutes in Ukrainian war and post-war conditions should be analysed not only by the fact of their formal existence, but also through the dynamics of the interrelated indices I^{obj} , I^{inst} , I^{rel} , which indirectly determine the possible trajectories of R_{bio} results at the macro-, meso- and micro-levels.

At the same time, the shape of the curves in Figure 4 is only an “indicator slice” of institutional processes. For analytical purposes, it is essential not only to record the nature of the movement of the relevant indices but also to understand the content of each stage, specifically the regulatory, organisational, and behavioural changes underlying the phases of emergence, institutionalisation, diffusion, stabilisation, stagnation, and re-institutionalisation.

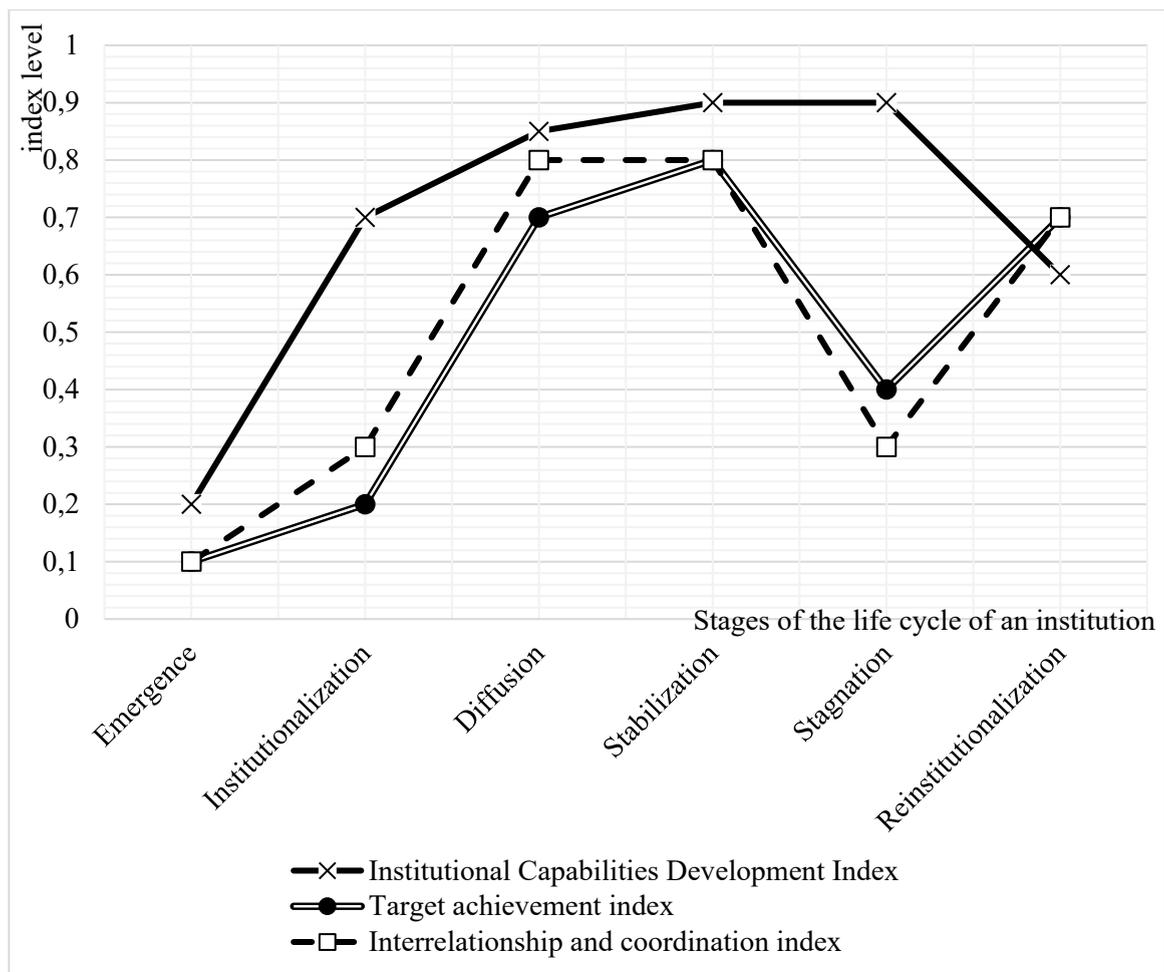


Figure 4. Phase-index trajectory of the life cycle of bioeconomic recovery (reconstruction) institutes

Source: compiled by the authors based on [11; 20; 32–33; 59; 62]

The stage of emergence (initiation) is associated with the emergence of the first regulatory and organisational decisions, pilot projects, the formation of a discourse on the need for a new institute (for example, the first regional support programs for biogas projects, individual schemes of “green” and transitional financing, experimental approaches to organic waste management [3]). At this stage, the institute primarily exists on the cognitive-discursive plane, embodied in a set of disparate initiatives, expectations, and expert proposals. Practices are fragmented, there is no established law enforcement tradition, stakeholder interaction is situational and personalised, and the institutional infrastructure is only outlined in the form of temporary organisational forms and informal coalitions.

At the stage of institutionalisation, there is a transition from discussions and pilot practices to a formalised “rules of the game regime”. Special laws and bylaws are adopted, specialised (sectoral, niche) strategies and programs emerge, responsible bodies and units are established, including through

interdepartmental coordination, procedures, regulations, and criteria for accessing resources are established, and the rights and obligations of participants are formalised. The central ideology of this stage is the codification and legitimisation of new institutional norms. At the same time, the material and technical base, organisational routines, and behavioural patterns change significantly more slowly, maintaining the time lag between the “normative proclamation” and the actual implementation of norms in practice, which is characteristic of transitional economies (which are in the process of recovery/reconstruction).

The diffusion stage (scaling of practices) is a phase of active spatial, sectoral and organisational “deployment” of the institute, when it goes beyond the boundaries of individual pilot sites and begins to reproduce itself as a relatively stable order of interaction in many territories and segments of the economy. As the number of projects and contracts increases, the circle of participants expands, and typical contractual and management practices are established. Procedures for the selection, financing, and monitoring of projects become standardised. At this stage, cluster and network effects appear, transaction costs of coordination decrease, the role of professional communities and associations increases, and the institute acquires the features of “everyday obviousness” for key stakeholders.

The stabilisation stage reflects the state when the institute becomes an organic part of the institutional environment of bioeconomic recovery. The main participants have adapted their strategies to its requirements, the main rules and procedures are perceived as the “normal background” of economic activity, and the results of the institute’s functioning demonstrate relative predictability. At the same time, the inertia of bureaucratisation, excessive formalisation of procedures, dominance of the “process” over the content of decisions, and decreased sensitivity to new risks and opportunities are growing. The institutional structure is gradually losing flexibility, creating the prerequisites for the transition from stability to stagnation.

The stage of stagnation or crisis is characterised by a progressive gap between formally declared norms and the real practice of their application. The effectiveness of the institute decreases, transaction costs increase, distrust and opportunistic behaviour of participants increase, and practices of formal compliance with requirements while actually ignoring them spread. The institute increasingly plays the role of an “empty shell,” which retains its legal force and organisational framework but loses the ability to coordinate the expectations and actions of stakeholders in the direction of bioeconomic goals. As a result, it turns into a source of institutional friction and a factor in consolidating resource- and carbon-intensive development trajectories (recovery).

The stage of re-institutionalisation (reform or replacement) is associated with a profound restructuring or replacement of the institute. It is not only about revising the regulatory framework, but also about reconfiguring the entire institutional structure, i.e., rethinking goals, shifting the emphasis in the incentive system, redistributing powers and responsibilities among actors, and reviewing decision-making procedures and accountability mechanisms. Re-institutionalisation can occur in two forms: internal reform (updating norms, procedures, and organisational forms) and the displacement of an outdated institute by new institutional configurations that better meet the technological, environmental, and socio-economic conditions of the bioeconomic transition. A successful version of this stage means that the updated institute restores its practical capacity, strengthens the quality of coordination, and again begins to support, rather than block, the bioeconomic development trajectory, thereby expanding the space of possible sustainable and fair recovery scenarios.

At the operational level, the differentiation of the stages in the life cycle of institutes can be carried out based on threshold values of the indices and an analysis of their dynamics over time and across territories or sectors of the bioeconomy. The emergence stage is characterised by a situation when all three indices I^{obj} , I^{inst} , I^{rel} remain below a specific critical value (for example, 0.3 on a normalised scale); institutionalisation is associated with a sudden increase of I^{inst} above a conditional threshold with simultaneously low and slowly growing I^{obj} and I^{rel} ; diffusion – with all three indices exceeding the average values and their steady growth; stagnation – with a combination of a stably high I^{inst} and stagnant or declining I^{obj} , I^{rel} ; re-institutionalisation – with the presence of institutionally fixed reforms in combination with a change in the trajectories of the indices. Specific thresholds and classification rules can be determined both expertly and based on empirical analysis of index value distributions.

In the war and post-war conditions of Ukraine, it is crucial to clearly distinguish between institutes that are at the stage of emergence (new formats of “green” and transitional financing, pilot measurement, reporting and verification systems for bioenergy), diffusion institutes (forms of inter-municipal cooperation in the field of waste management that are already spreading across the regions), and stagnation institutes (traditional mechanisms of tariff formation, fossil fuel subsidies, etc.). Such differentiation allows not only to fix the state of the institutional environment, but also to purposefully “adjust” the motivational mechanism to strengthen institutes that demonstrate potential for accelerating bioeconomic recovery, and transform or gradually displace those that reproduce resource- and carbon-intensive trajectories.

In the final dimension, the proposed methodology and technique combine qualitative insights into the essence and meaningful composition and architecture of the motivational mechanism with formalised diagnostic and comparative analysis procedures. This creates a basis for further modelling the relationship between institutional parameters $Inst_{bio}$, integrated institutional capacity $I_{Inst}^{(g)}$, and bioeconomic recovery results R_{bio} at macro-, meso- and micro-levels. In essence, we are discussing the transition from a descriptive statement, such as “the motivational mechanism is strong/weak,” to a conceptually and empirically grounded assessment of how institutes structure the space of possible development trajectories and how they redistribute probabilities between alternative future scenarios.

In the philosophical-economic perspective, the motivational mechanism appears not only as a set of incentives, but as a system that embeds in the decisions of subjects a particular vision of time (the ratio of short- and long-term benefits), risk (the willingness to take on the uncertainty of the bioeconomic transition), justice (the balance between private and public benefits, between current and future generations), as well as the permissible limits of intervention in resource-natural systems. Formalisation through $Inst_{bio}$, $I_{MM}^{(g,n)}$, $I_{Inst}^{(g)}$ and R_{bio} allows to “translate” these, at first glance, purely normative categories into the dimension of operational decisions, which establishes which institutes, at which stages of the life cycle, with which configuration of relations between stakeholders, actually bring the economy closer to biophysical sustainability, and which ones consolidate the inertia of the exhausting growth model.

Thus, the methodology for assessing the architecture of the motivational mechanism of bioeconomic recovery performs a dual function. On the one hand, it is a tool for scientific reflection, allowing us to view institutes not as a “given,” but as historically variable and controllable constructions, the internal logic of which can both accelerate and hinder the transition to a bioeconomic paradigm. On the other hand, it creates a practical framework for policy, setting criteria for the integrity, coherence, adaptability, fairness and effectiveness of the institutional architecture, allowing it to be adjusted in the direction in which motivational structures do not simply accompany, but normatively and behaviourally consolidate the bioeconomic trajectory of post-war development.

Conclusions

Theoretical and methodological elaboration of the motivational dimension of bioeconomic recovery (reconstruction) enables us to re-evaluate how institutes, tools, and subject expectations shape the space of possible development trajectories in Ukrainian war and post-war realities. In this context, the bioeconomic paradigm appears not only as a set of technological

or industry priorities, but as a special way of organising interactions between the economy and the natural environment, between the state, the market and the community, between short-term survival needs and long-term sustainability requirements. In such a vision, the motivational mechanism is the central link through which the determinants of post-war reconfiguration – resource, environmental, institutional, and value – are transformed into specific decisions regarding investments, innovations, the organisation of production, and consumption.

Theoretical synthesis reveals that none of the traditional directions of economic thought can independently account for the complexity of motivational processes in the bioeconomic transition. Only the integration of neoclassical and Keynesian ideas about profitability, risk and aggregate demand, the institutional approach to the rules of the game and transaction costs, the evolutionary vision of the selection of technological and organisational practices, behavioural ideas about bounded rationality and bias, as well as spatial-cluster concepts, allows us to form a multidimensional picture. In this picture, the motivational mechanism appears simultaneously as a structure of incentives, as a process of adaptation and learning, as a configuration of power and cooperative relations, “embedded” in specific territorial and sectoral contexts.

The conceptualisation of the institutional space of the motivational mechanism in the form of $Inst_{bio}$ and the “institutional cube” allowed us to organise the diversity of institutional forms by levels, functions, and typologies. This made it possible to analyse the motivational mechanism not as a sum of disparate measures, but as an architecture in which the combination of subsystems and types of institutes determines the contours of what is possible for subjects. At the same time, the quality of the motivational environment depends not only on the presence of individual institutes, but on their internal coherence, transparency, adaptability, and ability to minimise the space for opportunism and “capture” of regulators.

A key finding is the identification of three fundamental groups of institutional motivators – infrastructural, innovative, and investment – and the demonstration that it is through these that the bioeconomic paradigm acquires operational content.

The index technique, built on a three-component description of institutional motivators (I^{obj} , I^{inst} , I^{rel}) and integral indices of institutional capacity, creates an opportunity to move from qualitative judgments to formalised diagnostics of the motivational mechanism. In this perspective, each institutional motivator is assessed not only from the point of view of the availability of an object base, but also from the perspective of the degree of institutionalisation and the nature of relations between stakeholders – ranging from trust and coordination to

conflicts and asymmetries of access. Aggregation of indices enables the obtaining of an integral assessment of the institutional capacity of the motivational mechanism for specific territories, clusters, or sectors of the bioeconomy, thereby facilitating a comparative analysis, identifying “strong” and “weak” links, and prioritising interventions.

The proposed phase-index trajectory of the life cycle of institutes strengthens this approach with a dynamic dimension. The combination of the indices I^{obj} , I^{inst} , and I^{rel} , along with the distinction between the stages of emergence, institutionalisation, diffusion, stabilisation, stagnation/crisis, and re-institutionalisation, allows for the classification of institutes not only by type but also by the phase of evolution. In turn, this enables us to link policy instruments to the life cycle of institutes. For Ukraine, where new formats of “green” financing, pilot MRV schemes and deep-rooted mechanisms of fossil fuel subsidies coexist, such differentiation is of fundamental importance.

From a philosophical-economic perspective, the proposed approach enables us to interpret the motivational mechanism of bioeconomic recovery as a means of collectively determining “permissible” trajectories for the future. Formalisation through $Inst_{bio}$, integral indices of institutional capacity and R_{bio} results does not remove the normative burden of these processes, but makes it analytically transparent.

Practical results are presented by the scientific construction of the need to systematically embed motivational and institutional diagnostics into the policy of post-war recovery. Our research demonstrates that it is necessary to evaluate strategies and programs focused on the bioeconomy not only by the volume of investments or the number of projects, but also by how the institutional capacity of key motivators changes, as well as which institutes are in the support phase and which are in the phase of inevitable reform. The proposed toolkit can serve as the basis for building monitoring systems, creating “heat maps” of institutional capacity in territories, substantiating funding priorities, and synchronising national, regional, and local policies for bioeconomic recovery.

Due to the complexity and multidimensionality of the issues, the proposed approach is open to further theoretical and empirical development. Further research may aim to test the index technique in a regional and sectoral context, calibrate weights in integral indicators, analyse the relationship between the institutional capacity of the motivational mechanism and the actual results of R_{bio} , and integrate the institutional and motivational framework with macroeconomic and spatial models of recovery. At the same time, the proposed conceptual and methodological framework already allows us to rethink the post-war recovery of Ukraine as a process in which institutes and motivational structures do not simply accompany the bioeconomic transition, but are its defining drivers.

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