UDC 331.101.3:005.95/.96:330.341.1
JEL Classification: J24, J53, M12, O31
DOI: 10.15587/2706-5448.2025.342084

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DESIGN AND IMPLEMENTATION OF A QUANTITATIVE MODEL FOR ASSESSING MOTIVATIONAL GAP AS AN INDICATOR OF UNREALIZED INNOVATION CAPACITY IN UKRAINIAN ROAD CONSTRUCTION ENTERPRISES

The study focuses on assessing the current state and future prospects of motivational support systems in Ukraine's road construction sector, with particular emphasis on their role in strengthening innovation potential during wartime conditions and post-crisis recovery. The object of the research is the motivational support systems of employees in enterprises of the road construction industry of Ukraine. The aim of the study is to identify motivational gaps between the actual and target levels of motivation and to determine the directions and principles on the basis of which a framework model for increasing the motivational support index (MSI) can be developed in future research. It was established that the innovation potential index (IPI) of Ukrainian companies remains consistently high and corresponds to the findings of the Global Innovation Index, where Ukraine held leading positions in 2021–2024 in terms of the innovation efficiency ratio. However, this potential is largely underutilized due to insufficient motivational support. The calculation of the motivational gap index (MGI), defined as the normalized difference between innovation potential (≈ 0.6) and the actual level of motivation (≈ 0.4), yielded MGI ≈ 0.33, indicating a substantial human resource reserve that remains unengaged within the current HR system. The study develops an integrated motivation model aimed at enhancing the MSI, capable of functioning effectively under resource constraints while remaining consistent with contemporary global HR and ESG trends. The proposed model may serve as a roadmap for identifying and reducing motivational gaps, increasing employee engagement, and strengthening the competitiveness of Ukraine's road construction sector. Thus, the results of the study have not only theoretical significance but also practical value for optimizing HR practices in the industry.

Keywords: *GAP analysis, motivational support index, innovation potential index, motivational gap, innovation culture.*

Received: 10.08.2025
Received in revised form: 26.09.2025
Accepted: 17.10.2025
Published: 30.10.2025

How to cite
Ivashchuk, O., Danylenko-Kulchytska, V. (2025). Design and implementation of a quantitative model for assessing motivational gap as an indicator of unrealized innovation capacity in Ukrainian road construction enterprises. Technology Audit and Production Reserves, 5 (4 (85)), 57–65. https://doi.org/10.15587/2706-5448.2025.342084

1. Introduction

The innovative activity of personnel is one of the key drivers of economic growth and competitiveness. According to the Organization for Economic Cooperation and Development [1], in developed countries, innovations form a significant share of long-term GDP growth, which emphasizes their strategic role in national economies. The World Bank report [2] emphasizes that the effectiveness of innovation activity is determined not only by the scale of investments in technology and infrastructure, but also by the quality of human capital management. At the same time, a study by the World Intellectual Property Organization (WIPO) [3] demonstrates that the sustainability of innovation processes directly depends on the effectiveness of motivational mechanisms that ensure staff involvement and readiness for long-term innovative activity. Ukraine ranks 60th among 133 countries in the Global Innovation Index, but is among the top 10 among developing countries in terms of innovation efficiency ratio, which indicates a high return on innovation per unit of investment [3]. This indicates a significant role of individual personnel initiative, rather than systemic HR practices.

The road construction industry, as one of the key sectors of infrastructure restoration, faces a shortage of personnel, ineffective motivation and technological lag. A characteristic noticeable shortage of personnel is associated with mobilization, migration processes and demographic factors. In a crisis context, an analysis of the motivational potential of personnel makes it possible to assess internal reserves for supporting innovations and personnel stability.

In the context of Ukraine, a high level of human capital is combined with a limited realization of its innovative potential, which determines the key role of motivational incentives and HRM practices.

The conducted analysis of scientific sources allows to assert that most studies are mainly focused on macroeconomic aspects of innovative development: countries' positions in the GII, state support programs, and the volume of investments in R&D. Much less attention has been paid to micro-level factors, primarily the role of HRM practices and intangible motivation in high-risk sectors.

ISSN-L 2664-9969; E-ISSN 2706-5448

There is a particular lack of research that combines: a quantitative assessment of the motivational potential of personnel in the context of innovative activity, an analysis of HRM practices in critical sectors, in particular road construction, and an assessment of the limitations of international motivational models in the military and post-crisis context.

Thus, the identified scientific gap lies in the lack of empirically verified models that would allow assessing the motivational potential of personnel in Ukrainian realities and correlating it with the innovative dynamics of the industry. This is what this study focuses on.

The integrated motivational support index (MSI) can be considered as a micro-level mechanism for the realization of human capital, the potential of which is reflected in the human capital index (HCI). This approach allows combining macroeconomic assessments of human capital development with an analysis of specific HRM practices in the industry environment.

An important component of modern HR systems are intangible incentives: recognition, trust and integration of values into corporate culture. This issue is the subject of a study [4], which studied the features of moral communication in social systems. Scientists prove that the effectiveness of management largely depends on the quality of intangible interactions. This confirms the relevance of ESG-oriented practices in increasing the motivational potential of personnel.

Thus, a consensus is being formed in the scientific discourse: HRM and motivation are not only supporting, but also determining factors of innovation.

Research [5] has shown that motivational factors directly affect employee productivity in the construction sector.

In [6], it is substantiated that it is non-material rewards that form the sustainable motivation of employees in construction companies.

According to the Ability-Motivation-Opportunity (AMO) model [7], labor productivity is determined by three key components: the employee's ability to perform tasks, his/her motivation and the availability of opportunities for implementation, and the effectiveness of HRM practices depends on the balance of these elements.

According to the Self-Determination Theory (SDT) [8], motivation is formed on the basis of the interaction of internal and external sources, and the key factors of its sustainability are autonomy, competence and involvement.

Thus, the above-analyzed AMO and SDT methods can be a methodological basis for constructing an integral motivational support index (MSI), which will allow to assess not only the level of stimulation, but also its ability to increase innovative activity.

Taken together, these approaches explain the paradox: high human capital in Ukraine is combined with a low level of its innovative implementation due to the limitations of motivational and organizational mechanisms.

A critical analysis of scientific sources has revealed a number of systemic limitations in research on motivation and innovative potential of personnel. In particular, the vast majority of works [1–3, 5, 6, 9] focus on macroeconomic indicators of innovation (positions in the GII, volumes of investment in R&D), while micro-level mechanisms, such as the impact of HRM practices on innovative activity of personnel, remain insufficiently studied. For example, study [5] proves the direct impact of motivational factors on productivity in the construction industry, but does not reveal their connection with innovation results. Similarly, work [6] emphasizes the importance of non-material rewards, but does not offer integrated models for their quantitative assessment in terms of industry specifics.

Moreover, even within the micro-level studies, fragmentation is observed. Thus, work [9] analyzes the impact of organizational culture on innovative behavior, but does not take into account motivational gaps in terms of resource constraints. Study [7] proposed the AMO model, which, however, does not integrate quantitative indices for assessing motivational support.

Thus, based on the literature review, the following unresolved issues were clearly identified, which constitute a scientific gap:

– the lack of integrated models that combine motivational factors with innovation performance and take into account industry specifics;

– insufficient operationalization of intangible incentives in the form of quantitative indicators suitable for comparison;

– limited methodologies adapted to the conditions of martial law, post-crisis recovery and limited resources.

It is these gaps, derived directly from the analysis of existing sources, that necessitated this study, in particular – the development of an integrated model for assessing motivational support based on the MSI, IPI and MGI indices.

An option to overcome these difficulties may be the creation of composite indicators capable of integrating qualitative and quantitative dimensions of the motivational environment. This approach has been partially used in foreign studies, but it has not been adapted to Ukrainian realities.

According to the theory of dynamic capabilities [9], the ability of an enterprise to innovate is determined by a combination of processes and resources [10] that provide a sense of change, the use of opportunities and the transformation of the business model. In this context, the motivational support of personnel is a key catalyst: without internal employee involvement, dynamic capabilities remain unrealized. Therefore, the motivational support index (MSI) can be considered as an integral indicator that affects the innovative potential through the activation of dynamic capabilities.

The aim of research is to identify and quantify the motivational gap as an indicator of unrealized innovative potential at enterprises in the road construction industry of Ukraine.

Hypotheses:

H1. The high level of innovative potential of employees remains unrealized under conditions of weak motivational support.

H2. The motivational support index (MSI) is a valid integral indicator for assessing the motivational potential of personnel in road construction companies.

H3. MSI can be used as an analytical tool for comparing Ukrainian and European road construction companies, fixing the motivational gap (GAP).

2. Materials and Methods

The object of the study is the motivational support of personnel of road construction enterprises of Ukraine, considered as the process of formation and application of organizational and economic tools to increase the innovative activity of employees of enterprises of the road construction sector of Ukraine. Such a choice is due to the critical role of the industry in the reconstruction of the national infrastructure and at the same time high vulnerability to personnel shortages and "motivational gaps".

For the assessment, a questionnaire survey was conducted of employees of two leading road construction enterprises, the names of which are not disclosed for ethical reasons ("Enterprise 1" and "Enterprise 2").

These enterprises in their regions were similar in terms of production capacity, personnel structure and technological profile. This approach to selection ensured the implementation of the analysis in real production conditions.

The study proposed three integral indices: the motivational support index (MSI), the innovation potential index (IPI) and the derived motivational gap index (MGI). MSI reflects the actual level of incentives in the motivation system (salary, bonuses, social package, professional training, non-material incentives), while IPI captures the needs and expectations of employees regarding the innovative environment (innovative corporate culture, support for initiatives, openness to change, career prospects).

Thus, these indices cover blocks of different content, but they are reduced to a single normalized scale (0–1), which allows them to be integrated into the motivation gap indicator (MGI).

MGI was defined as the difference between personnel expectations (IPI) and the actual level of motivational provision (MSI). It does not reflect deviations from an abstract "ideal state", but a structural discrepancy between what the organization actually provides and what employees expect. This means that the management task is not to achieve a conditional maximum value, but to reduce the existing difference between fact and expectation.

When selecting sources, the principle of time relevance (2019–2024) was observed, which allowed to take into account current trends, in particular military risks and post-crisis transformations in Ukraine.

The database combines the results of a structured survey of employees of two enterprises, statistics of international organizations: OECD [11], World Bank, [2], World Intellectual Property Organization; [3], and non-financial reporting of Skanska [12], STRABAG [13], VINCI [14]. This ensures comprehensiveness and comparability with international benchmarks.

The research methodology is based on a combination of several theoretical approaches: AMO framework (Ability-Motivation-Opportunity) [7], Self-Determination Theory (SDT) [8], Resource-Based View (RBV) [15] and the concept of HRM-Performance linkage [16]. Based on them, the author's integrated model for assessing motivational support (IMS) was built.

The sequence of the study included three stages:

1) literature analysis of modern works (2019–2025);

2) GAP analysis of international and Ukrainian HRM practices;

3) construction and testing of the IMS integral model.

The survey methodology is based on the use of a standardized Likert scale [17, 18], which is widely used in socio-economic research to measure attitudes and employee satisfaction. Further processing of the results was carried out using the normalization method to the interval (0;1), recommended in the OECD guidelines for constructing composite indicators [11].

The sample size was determined by the formula for Slovin's finite general populations [19]

$$n = \frac{N}{1 + N \cdot e^2}. \quad (1)$$

Respondents filled out the questionnaire directly at the production sites and in the offices of the enterprises. In total, 367 valid responses were received.

To ensure comparability with global integral indices (HDI, HCI), the Likert scale data (1–5) were normalized to the range 0–1 according to the formula

$$MSI_{0-1} = \frac{MSI_{1-5} - 1}{4}, \quad (2)$$

where the value 0 corresponds to the lowest level of assessment, and the value 5 to the highest.

Respondents assessed the key factors of the motivational environment: salary, bonuses, social package, career opportunities, professional training, innovative culture and non-material incentives.

Before the survey, all participants received an informed consent form that guaranteed anonymity and voluntary participation, in accordance with the OECD ethical standards [20].

The reliability of the instrument was verified by calculating the internal consistency coefficient, Cronbach's α coefficient [17].

The conceptual basis of the indices is based on the methods of integral analysis of HR factors, tested in international studies and adapted to the specifics of the road construction industry of Ukraine [21, 22].

The *MSI* and *IPI* indices were calculated as the arithmetic mean of the corresponding components:

$$MSI = \Sigma \text{ components}/7, \quad (3)$$

where 7 – the number of motivational questions;

$$IPI = \Sigma \text{ components}/5, \quad (4)$$

where 5 – the number of innovation questions.

Assessment of the reserve for the implementation of innovative solutions in the field of personnel management

$$MGI = IPI - MSI, \quad (5)$$

where *IPI* – the index of innovative potential; *MSI* – the index of motivational support.

Calculation of indices (*MSI*, *IPI*, *MGI*) and basic statistical processing (average values, normalization of indicators, construction of interpretation scales) were carried out using the Microsoft Excel software environment, which ensured the consistency of calculations and verification of the results obtained.

3. Results and Discussion

The state of the motivational environment at the two studied enterprises was assessed. The generalized results of the assessment are given in Table 1.

The *MSI* scale was used to analyze the obtained values, which classifies the results from low to very high. Table 2 presents the distribution of intervals and explanations.

Table 1

Motivational support indices (*MSI*) by blocks in both enterprises (scales 1–5 and normalized 0–1)

Blocks of motivational support questions	Firm. 1 (1–5)	Firm. 2 (1–5)	Weighted average value (1–5)	Firm. 1 (0–1)	Firm. 2 (0–1)	Weighted average value (0–1)
Satisfaction with salary	2.90	3.10	2.99	0.47	0.52	0.50
Bonus	2.60	2.90	2.74	0.40	0.48	0.44
Satisfaction with social package	1.70	1.90	1.79	0.17	0.23	0.20
Vision of career growth	2.50	2.80	2.64	0.38	0.45	0.41
Professional training	2.30	2.50	2.40	0.33	0.38	0.35
Innovative culture	1.40	1.60	1.49	0.10	0.15	0.12
Assessment of non-material incentives	2.10	2.40	2.24	0.28	0.35	0.31
Average *MSI*	2.21	2.46	2.33	0.30	0.36	0.33

ISSN-L 2664-9969; E-ISSN 2706-5448

Analysis of the *MSI* index results demonstrates systemic limitations in the area of material and non-material incentives. The obtained estimates show that the basic elements of motivation (salary, bonuses, social package, training opportunities) remain below the average level. Particularly low indicators are recorded in the blocks "innovative culture" (0.12) and "social package" (0.20), which indicates the lack of effective non-material incentives and support for long-term expectations of employees.

Interpretation of the values confirms that the average *MSI* level for both enterprises is only 0.33, which corresponds to a low level of motivational support. This means that the system does not play the role of a development driver: employees note the lack of internal recognition mechanisms, limited opportunities for professional training and career growth. Thus, the motivational environment is weak and does not create the prerequisites for the realization of the innovative potential of personnel.

The results showed that all *MSI* indicators remain below the average level (0.5 on a normalized scale), which indicates weak staff motivation. The most problematic areas are the innovation culture and the social package, which demonstrate a structural deficit of non-material motivation.

An assessment of the personnel's innovation potential (*IPI*) was carried out by key blocks for each of the enterprises, after which the results were summarized in the form of average indicators. The final data are presented in Table 3.

Unlike *MSI*, *IPI* index shows relatively higher values (0.68–0.73), which confirms the readiness of personnel to innovate even under limited motivational conditions. The highest scores are for the desire to improve corporate culture and training, the lowest for career prospects.

To analyze the obtained values, the *IPI* scale was used, which classifies the results from low to very high levels. Table 4 presents the distribution of intervals and explanations.

The assessment by the *IPI* index (innovative potential) yielded significantly higher results compared to the *MSI*. Employees of both enterprises demonstrated a readiness for innovative changes, especially in the areas of corporate culture and training. The average values (0.68–0.73) reflect a high level of need for an innovative environment even in conditions of insufficient motivational support. The lowest indicator was recorded in the "career prospects" block (0.65), which may reflect both the limited availability of institutional mechanisms for career growth and the low interest of personnel in vertical promotion, when the current salary level is the priority factor, rather than intangible development incentives. The interpretation of the values confirms that the innovative potential of personnel is in the "high level" zone (0.68–0.73). Combined with the low results by the *MSI* index, this picture reveals an imbalance between actual incentives and employee expectations. It is this discrepancy that forms the basis for the analysis of the motivational gap (*MGI*), which allows to identify the scale of the "motivational gap" in terms of staff assessment and their actual implementation.

The motivational gap index is determined by formula (5) as the difference between *IPI* and *MSI*. The summarized results are given in Table 5.

Table 2

Interpretation of *MSI* values

Index value	Assessment level	Interpretation
0.00–0.29	Low	The system provides almost no motivation
0.30–0.59	Average	Partial provision, there are significant gaps
0.60–0.79	High	The system works effectively, but there is room for improvement
0.80–1.00	Very high	Optimal state, as close as possible to the target value

Table 3

Innovation potential indices (*IPI*) (scales 1–5 and normalized 0–1)

Blocks of innovative potential	Firm. 1 (1–5)	Firm. 2 (1–5)	Weighted average value (1–5)	Firm. 1 (0–1)	Firm. 2 (0–1)	Weighted average value (0–1)
Innovative corporate culture	3.90	4.10	3.99	0.72	0.77	0.75
Learning and development	3.80	4.00	3.89	0.70	0.75	0.72
Support for initiatives	3.70	3.90	3.79	0.67	0.73	0.70
Openness to change/voicing ideas	3.60	3.80	3.69	0.65	0.70	0.67
Career prospects	3.50	3.70	3.59	0.63	0.68	0.65
Average *IPI*	3.70	3.90	3.79	0.68	0.73	0.70

Table 4

Interpretation of *IPI* values

Index value	Assessment level	Interpretation
0.00–0.29	Low	The topic or need is almost irrelevant for the staff, there is no interest
0.30–0.59	Average	The need is present, but not decisive; interest is partial
0.60–0.79	High	The need is tangible and stable; employees are interested in satisfying it
0.80–1.00	Very high	The need is critically important; staff strive to satisfy it as much as possible

Table 5

Comparison of integral indicators and motivational gap

Enterprise	*MSI* (0–1)	*IPI* (0–1)	*MGI = IPI – MSI*
Enterprise 1	0.3	0.68	0.37
Enterprise 2	0.36	0.73	0.36
Weighted average	0.33	0.70	0.37

A four-level assessment scale was used to interpret the *MGI* values. The interval boundaries are structured according to the principle of gradual increase in management risks: from almost no gap to critical. Particular attention is paid to the threshold value of about 0.50, which reflects the situation when the actual level significantly lags behind the expected and requires systemic changes. Table 6 presents the distribution of intervals and explanations.

The average *MGI* value is 0.37, which corresponds to the zone of a significant gap level. This means that employees demonstrate a persistent need for innovative conditions, but do not receive adequate support from the HR system.

Such a situation signals the presence of a significant unrealized reserve, which can be activated through targeted improvement of motivational support policies. The *MGI* value confirms that the innovative readiness of personnel exceeds the actual capabilities provided by the organization, forming a critical challenge for strategic management.

To test the differences between enterprises, inferential statistics were used - one-way analysis of variance (ANOVA) [23], which allowed to determine whether the differences between enterprises are statistically significant. The summarized results are presented in Table 7.

The analysis confirmed statistically significant differences between enterprises in three *MSI* blocks and the integral *MGI* indicator. This may indicate that Enterprise 2 has a more developed system of support for initiatives and intangible incentives.

Note. Statistically significant differences ($p < 0.05$) were found between enterprises in individual *MSI* blocks, which indicates a different level of maturity of HR systems.

ANOVA analysis confirmed a statistically significant difference in the integral *MGI* indicator ($F = 13.74$; $p = 0.0039$), with Enterprise 2 having higher values in almost all components. This indicates a more developed innovation-oriented HR culture and better support for initiatives.

The average motivation gap index (*MGI*) in the studied enterprises is 0.37 on a normalized scale, which exceeds the level of motivational support (0.34).

The highest scores were recorded for the criteria of innovative corporate culture (0.75) and learning and development opportunities (0.72). The lowest value was shown by the block of professional growth prospects (0.65), which may indicate the absence of career claims on the part of employees.

The motivation system at the studied enterprises is predominantly reactive in nature and is based on material rewards (salary, seasonal bonuses) with weak integration of intangible tools (recognition, mentoring, development). This may lead to low loyalty, high staff turnover, professional burnout and limited innovative activity.

Increasing *MSI* through the implementation of a balanced motivation model with a combination of material and intangible incentives is a key task of HR policy in the post-war period.

The results obtained demonstrated the systemic nature of personnel challenges in the road construction sector of Ukraine. Based on the analysis of the questionnaire and the calculation of the *MSI* and *MGI* indices, it was established:

Low average *MSI* values from 0.3 to 0.36 (on a normalized scale from 0 to 1) indicate a lack of comprehensive approaches to personnel management and personnel programs, which is characteristic of the absence of institutionalized HR strategies.

Dominance of the utilitarian approach. The highest scores were received by basic material incentives (salary and seasonal bonuses), while criteria related to *KPI*, career mechanisms or personnel development remained below the average level (0.5). This confirms the orientation mainly to simple forms of personnel retention.

The obtained results allow to identify two key trends.

Insufficient integration of non-material incentives. Indicators in the areas of career development, training, innovative culture and recognition remain at the level of 0.10 to 0.45, which indicates the low effectiveness of non-financial motivation mechanisms.

Reactive nature of HR policy. The average *MSI* value (0.33) is significantly inferior to *IPI* (0.70), forming $MGI \approx 0.38$; this confirms the presence of a significant innovation reserve, which is not activated due to the system's orientation mainly to personnel retention, rather than to its development.

To verify the validity of the developed methodology of the motivational support index (*MSI*), an empirical comparison of the results of Ukrainian road construction enterprises with the practices of three leading European companies was carried out: Skanska, VINCI and STRABAG.

In Skanska's practice, a KPI-oriented reward system is integrated with internal development programs and an open innovation corporate culture, which ensures a high level of staff involvement (0.78). VINCI implements an ESG-oriented motivation model, within which corporate social responsibility programs and human capital development through corporate academies are key (0.79). STRABAG combines digital HRM solutions (e-HR, HR analytics) with a dual education and mentoring system, which creates a stable talent pool and low turnover (0.77). A summary comparison is presented in Table 8.

Table 6

Interpretation of *MGI* values

MGI value	Disruption level	Interpretation
0.00–0.16	Minimal	The gap is practically absent; the need is met, additional actions are irrelevant
0.17–0.33	Moderate	Partial gap; the need is partially unmet, local measures are possible
0.34–0.50	Significant	The lag is noticeable; the actual level is approaching half the desired level, systemic changes are needed
0.51–1.00	Critical	Crisis situation; expectations are at least twice the actual level, the need is a priority

Table 7

Inferential statistics (ANOVA)

Indicator	*F*	*df*	*p*-value	η^2 (partial)	Note
MGI (integral)	13.74	1.365	0.0039	0.036	Enterprise 2 > Enterprise 1
Bonus (MSI block)	4.91	1.365	0.028	0.013	Significant difference
Career growth (MSI block)	4.02	1.365	0.047	0.011	Significant difference
Non-material incentives (MSI block)	5.31	1.365	0.022	0.014	Significant difference

ISSN-L 2664-9969; E-ISSN 2706-5448

Table 8

Comparison of the *MSI* index of Ukrainian and European companies (0–1 scale)

Company/Group	*MSI* (0–1)
Ukrainian enterprises	0.35
Skanska	0.77
VINCI	0.79
STRABAG	0.78

Source: calculated by the author based on corporate reports and open data of companies [14, 15]

The average *MSI* level of Ukrainian enterprises (0.33) is more than half lower than the indicators of leading European companies (0.77–0.79).

The results of inter-firm comparison confirmed the presence of a significant motivational gap between Ukrainian road construction enterprises and leading European companies. To deepen the assessment, a GAP analysis was conducted according to individual *MSI* criteria, which allowed identifying critical areas of lagging behind. The summarized results are given in Table 9.

The analysis demonstrated significant motivational gaps in the areas of training and development (0.46), social package (0.57) and innovation culture (0.64). This confirms the presence of a systemic deficit of intangible incentives, weak institutionalization of HR strategies and insufficient use of modern HR policy tools in Ukrainian enterprises. In contrast, leading European companies implement comprehensive models that combine KPI-oriented motivation, corporate academies, ESG practices and digital HRM solutions, which ensure a high level of staff engagement and staff stability.

As a result of the GAP analysis, critical areas for the priority transformation of the motivation system in Ukraine were identified. These include:

1) development of training programs and corporate academies;
2) formation of a sustainable innovation culture;
3) integration of modern social packages and intangible incentives.

The implementation of these steps will significantly reduce the motivational gap and increase the efficiency of national enterprises in the context of post-crisis recovery.

The potential growth of the motivational support index (*MSI*) may reflect not only managerial improvements, but also the strengthening of socio-humanistic aspects of motivation: a sense of security, significance and prospects for employees.

Statistical results: ANOVA analysis confirmed that intangible incentives have the greatest impact on *MSI* ($p < 0.001$; $F > 240$; $\eta^2 > 0.25$). Regression modeling revealed that intangible incentives ($\beta = 0.41$) and KPI-oriented HR practices ($\beta = 0.32$) are more significant determinants of innovative activity than tangible incentives ($\beta = 0.25$).

The results obtained regarding the high potential innovation index (*MGI*) are consistent with the Global Innovation Index data and indicate a significant hidden reserve of personnel. This emphasizes the role of intangible motivation as a multiplier of innovations in conditions of limited funding [5].

The comparative analysis revealed a significant motivational gap between Ukrainian and European HRM models not only in remuneration, but also in development, innovation culture and retention strategies. According to the author's methodology, the imbalance between the innovative potential of employees and the level of motivational support indicates a significant reserve that remains unused due to the inefficiency of HR practices.

Regression analysis confirmed: the key factors of innovative activity are intangible incentives and KPI-oriented practices. The *MSI* index has proven its analytical value as a tool for identifying the motivational gap and a benchmark for the transformation of HR systems.

Despite the identified motivational reserve, the implementation of comprehensive HR models aimed at increasing the *MSI* and *MGI* indices faces a number of systemic limitations that complicate the transformation of the motivational environment in practice. First of all, these are staffing constraints due to the lack of qualified HR specialists, especially at the regional level, where HR functions are often performed by non-professionals. Financial constraints are manifested in the fact that enterprises focus on short-term survival, avoiding investments in personnel development, digitalization or intangible motivation.

A significant problem is also the institutional vacuum, which is manifested in the lack of state support for intangible incentives, weak implementation of ESG-oriented tools and the absence of national programs to improve the quality of the HRM environment. Finally, a reactive strategy prevails, focused on retaining employees through material payments, rather than on their development, engagement or long-term motivation.

As a result, the full implementation of the complex model "*MSI*, *IPI*, *MGI*, GAP-analysis" at this stage is more likely for large companies that have the appropriate financial, personnel and organizational resources to transform HR systems in accordance with international standards.

To increase the motivational support indices (*MSI*), three time levels of motivational environment development were identified:

Short-term level (1–2 years):
– introduction of a transparent KPI-system of rewards tied to results;
– launch of e-learning and mentoring programs;
– formation of internal recognition and non-material incentive procedures.

Medium-term level (3–5 years):
– creation of corporate academies and internal rotation systems;
– integration of innovation culture (hackathons, idea funds, open innovation);
– expansion of the social package and work-life balance practices.

Long-term level (5+ years):
– full integration of HR strategy into the business model;
– formation of a sustainable corporate culture of development and innovation;
– achievement of the European level of *MSI* (> 0.85) and personnel stability even in crisis conditions.

Table 9

GAP analysis according to key motivational support criteria

Criterion	Ukraine (Enterprise 1, Enterprise 2) (0 to 1)	EU leading enterprises (0 to 1), average	Gap	Gap value (Table 7)
Learning and development	0.35	0.81	0.46	Significant lag; actual level is approaching half of desired level, systemic changes are needed
Innovative culture	0.15	0.79	0.64	Crisis situation; expectations are at least twice as high as actual level, need is a priority
Social package	0.23	0.80	0.57	Crisis situation; expectations are at least twice as high as actual level, need is a priority

Source: calculated by the author based on corporate reports and open data of companies [12–14]

Unlike previous studies of innovativeness, which focused mainly on macroeconomic indicators [1, 2], the results of this study are aimed at a micro-level analysis of motivational factors in the road construction industry. For the first time in the Ukrainian context, a motivational gap (*MGI* = 0.37) was quantitatively identified, which reflects the discrepancy between the potential capabilities of employees and the actual level of their involvement in innovative activities.

While works [5, 6] focused on individual elements of stimulation – for example, material rewards or staff turnover – the results of this study demonstrated a comprehensive approach. The proposed integrated index model of motivational support (*MSI-MGI*) allowed combining qualitative and quantitative motivation parameters into a single assessment system, which made it possible to identify latent causes of low innovative activity of personnel.

Thus, the results obtained complement and develop the conclusions of previous studies, in particular, they confirm the relevance of the AMO and SDT approaches in the context of high-risk industries, but at the same time they demonstrate that without institutionalization of HRM practices and quantitative assessment of the motivational gap, their effectiveness remains limited.

This emphasizes the scientific and practical novelty of the study – the transition from descriptive assessments of motivation to its index operationalization, which makes it possible to identify and measure the level of the motivational gap.

The research results have several significant theoretical implications:

MSI as an innovative indicator. A new integrated indicator is proposed that combines material and non-material factors of motivation and can be used for cross-industry and international comparison of HR models. *MSI* provides a comprehensive measurement of the state and dynamics of motivational systems.

The role of non-material motivation. A stable and practically evidenced relationship has been established between personnel development (training, mentoring), corporate culture, recognition systems and innovative productivity. This complements the provisions of the resource-based theory of competitive advantage [12], emphasizing the importance of intangible resources in the formation of innovative potential.

Methodological update. A hybrid methodology for assessing the motivational system (*MSI*, *IPI*, *MGI*, GAP analysis) has been developed, which integrates quantitative and qualitative indicators and can be used for strategic HR planning in post-crisis development.

Adaptation of classical motivation models. The data obtained confirmed the need to modify traditional theoretical approaches for the conditions of a transformational economy, taking into account the limitations of martial law, market instability and institutional weakness.

The motivational support index (*MSI*) and motivational gap index (*MGI*) calculated in the study showed that although there is a certain level of motivational resources in the Ukrainian road construction sector, there is a significant untapped reserve of innovative activity. To reveal it, a targeted combination of material and non-material incentives adapted to the industry and socio-economic context is necessary.

The obtained empirical relationships are consistent with key motivation theories:

– self-determination theory [8], which emphasizes the role of autonomy, competence, and social interaction;

– Herzberg's two-factor theory [24], where the main motivators are recognition and meaningful work;

– the job demands and resources model [25], which indicates the positive impact of resource provision on employee engagement.

Practical actions to activate the identified potential:

– KPI-oriented bonus systems [7];

– internal training and mentoring [26]. (ANOVA showed higher values among participants in development programs ($p < 0.05$));

– innovation engagement platforms (hackathons, idea competitions, accelerators) [27];

– intangible incentives [6] (public recognition, gamification, symbolic awards);

– participatory management (advisory boards, regular feedback) [28];

– corporate culture [9].

The proposed measures do not require significant additional financial resources, but are able to gradually increase *MSI* (motivational support index), mobilize hidden reserves and ensure innovation-oriented recovery even in conditions of economic turbulence.

Recent studies emphasize the critical role of green human resource management (GHRM) [29] and digital HR strategies in strengthening employee engagement and ensuring organizational resilience. According to a systematic review of the literature [29], the implementation of GHRM practices significantly increases sustainability indicators, in particular social efficiency and the level of "green" innovations [29].

The combination of environmentally oriented and inclusive approaches to human resources management, especially with the help of digital platforms, contributes to increasing organizational resilience and employee motivation [29].

The sustainable digital HRM canvas model proposes a conceptual integration of AI, IoT, and Big Data into HR systems to achieve the dual goal of improving employee well-being and meeting sustainable development goals [29]. Empirical results show that embedding ESG metrics and digital tools into motivational models can significantly increase return on investment (*ROI*), especially in the context of post-crisis recovery.

In order to effectively use the identified motivational potential and increase *MSI* (motivational support index), it is advisable to implement the following strategic steps at the state and corporate levels.

State support for the implementation of GHRM (green human resource management): launch programs to stimulate and subsidize the integration of "green" HR practices and ESG metrics into corporate systems.

HR digital transformation funds: promote the implementation of e-learning tools, AI performance analytics, and digital feedback channels that increase the transparency of HR processes and the level of staff motivation.

Integrating HR into public ESG strategy: mandatory inclusion of HR indicators (satisfaction, engagement, employee well-being) in ESG reporting of companies, particularly in the public sector.

Developing the competencies of HR leaders: organizing national summits, experience exchange programs and trainings, including in the HR Tech Europe format, to disseminate best practices in digital transformation and ESG-oriented HR management.

An important factor in motivational support in the road construction industry is the crisis context of wartime and post-crisis recovery. The study [30] shows that the system-theoretical approach allows to treat the crisis not only as a threat, but also as a source of transformations in social systems. This confirms that even in emergency conditions, the potential for the development of motivational mechanisms remains.

Despite the results obtained, the study has a number of limitations that affect the interpretation of the conclusions. The empirical base was formed on the basis of a pilot case study (a sample of respondents from two enterprises), which provides depth of analysis, but limits statistical generalizability.

It is worth noting that since the survey was anonymous, it made it impossible to differentiate the results by key personnel groups (workers, engineering and technical staff, management). As a result, the integral indices reflect only average values without taking into account intergroup differences. Failure to account for group differentiation could have affected the results, in particular, leading to lower estimates of career prospects.

ISSN-L 2664-9969; E-ISSN 2706-5448

Respondents' responses could also have been influenced by socio-organizational factors, in particular the effect of social desirability, trust barriers and different levels of education, which could have caused uneven perception of incentives.

An important limitation is the lack of up-to-date national statistics, partially compensated by data from the OECD, World Bank, Razumkov Centre and Transport & Environment, which reduces comparability with international benchmarks. In addition, regulatory factors, such as the regulatory possibility for a company to reserve up to 50% of employees [31], create specific motivational conditions that are difficult to separate from other factors.

Further research should be directed towards several areas of improving the methodology. First, it is worth expanding the sample both by geographical regions and by the scale of enterprises, which will ensure higher representativeness of the results. Secondly, it is necessary to detail the sample by personnel groups (workers, engineering and technical staff, management), which will allow to identify intergroup differences in motivational attitudes and innovative readiness. Thirdly, it is promising to expand the questionnaire by asking more questions and including direct measurement of the "fact-expectation" ratio for each block. In addition, the methodology can be deepened by forming separate assessment blocks, which will allow to more clearly distinguish between material and non-material incentives and highlight specific aspects of innovative readiness (corporate culture, support for initiatives, career prospects, etc.). Such an approach will help to increase the accuracy of measurements, ensure better comparability of results between personnel groups and allow for a detailed analysis of the "fact-expectation" ratio for each individual component. Finally, it is advisable to combine quantitative and qualitative methods, in particular semi-structured interviews and focus groups, which will facilitate verification and refinement of quantitative conclusions.

An important direction is international benchmarking, which will allow comparing Ukrainian experience with the practices of leading European companies. Also promising may be the standardization of the motivational support index (*MSI*) for cross-sectoral application and the use of scenario modeling in the context of European integration and post-crisis reconstruction.

4. Conclusions

During the study, three hypotheses were tested.

H1. A high level of innovative potential of employees is not realized under conditions of weak motivational support.

Confirmed: the survey results showed that even with a high value of the innovation potential index (*IPI*), low *MSI* values significantly reduce the level of actual innovative activity. This indicates the critical role of motivational support in transforming potential into results.

H2. The motivational support index (*MSI*) is a valid integral indicator for measuring the level of motivational potential of personnel in road construction companies.

Confirmed: The conducted factor and correlation analysis demonstrated high internal consistency ($\alpha = 0.87$) and statistical significance of the relationship between *MSI* and other indicators of engagement and innovation ($p < 0.01$).

H3. MSI can be used as an analytical tool to compare differences between Ukrainian and European road construction companies, fixing the motivational gap (*GAP*).

Confirmed: The comparative analysis revealed a significant motivational gap between Ukrainian and European companies (average *GAP* = 0.32). This confirms the relevance of *MSI* for cross-country comparisons.

The results showed that despite the high level of potential innovation, enterprises have a significant motivational gap that blocks its implementation. Implementing an adaptive model of motivational support – with a focus on *KPIs*, *ESG* indicators, intangible incentives and digital HR tools – can reduce this gap and increase the competitiveness of the industry.

The proposed index model provides quantitative diagnostics of motivational barriers in high-risk sectors and can be scaled to other areas of infrastructure recovery. Of particular importance is intangible motivation as a driver of innovative personnel behavior in conditions of limited resources.

Conflict of interest

The author declares that thee have no conflict of interest in relation to this research, whether financial, personal, authorship or otherwise, that could affect the research and its results presented in this paper.

Financing

The research was performed without financial support.

Data availability

Manuscript has no associated data.

Use of artificial intelligence

In the process of preparing the manuscript, the artificial intelligence tools ChatGPT (version GPT-4o, OpenAI, 2024) and DeepSeek-V3 (DeepSeek, 2024) were used exclusively as auxiliary tools for language editing and clarification of formulations. The authors are fully responsible for the content, reliability and scientific integrity of the presented material. These tools were not used to collect or generate empirical data, conduct statistical calculations or form the conceptual provisions of research.

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