Эмпирическое исследование управленческих механизмов мотивации и стимулирования работников в условиях устойчивого цифрового развития

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В данной статье рассматривается современное применение механизмов мотивации и стимулирования работников в условиях цифрового развития и активизации деятельности компаний в рамках международной ESG-повестки. Авторами анализируется влияние текущих факторов, таких, как материальное и нематериальное вознаграждение, а также обеспечение благополучия и вовлеченности работников, на их мотивацию и удовлетворенность условиями работы. При этом уделяется внимание имеющимся противоречиям, связанным с влиянием современных цифровых инструментов, которые могут играть как поддерживающую, так и сдерживающую роль в мотивации персонала. Подчеркивается важность использования цифровых подходов при проведении аналитической работы и обеспечении интеллектуализации и автоматизации управленческой деятельности социальной и экологической направленности в рамках мотивации и стимулирования. В статье, на базе проведения эмпирического и множественного регрессионного анализа, формулируются и доказываются гипотезы о взаимосвязи и взаимовлиянии мотивирующих факторов на удовлетворенность и вовлеченность персонала в условиях цифровизации и обеспечения устойчивого развития. В ходе доказательства сформулированных гипотез авторами разрабатываются новые теоретические положения и практические рекомендации по созданию механизмов мотивации и стимулирования персонала в контексте цифровой трансформации. Целью исследования является проведение оценки влияния мотивационных факторов, таких, как заработная плата, нематериальное воздействие, наличие механизмов обратной связи, а также обеспечение благополучия работников, на их вовлеченность и удовлетворенность трудом (с учетом стимулирующей роли цифровых инструментов). На базе этого должны быть предложены практические рекомендации для менеджмента современных компаний по созданию основ эффективной работы персонала в условиях цифровой трансформации и реализации ESG-стратегии. Задачи исследования: 1) оценить влияние различных мотивационных факторов на вовлеченность и удовлетворенность работников; 2) проанализировать влияние цифровых инструментов на мотивационные факторы; 3) выявить модерирующее влияние цифровых инструментов на мотивационные факторы; 4) предложить рекомендации по формированию мотивационных факторов в условиях цифровой трансформации и устойчивого развития. Объектом исследования являются работники современных компаний, участвующие в международных исследованиях по вопросам удовлетворенности трудом. Методы исследования: множественный регрессионный анализ, анализ данных, обобщение, логический анализ и кейс-стади.
Ключевые слова: устойчивое развитие, ESG-повестка, управление, мотивация, стимулирование, цифровая трансформация, механизм, удовлетворенность, цифровые инструменты.

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An empirical study of management mechanisms for motivating and incentivizing employees in the context of sustainable digital development

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This article examines the current application of employee motivation and incentive mechanisms in the context of digital development and activation of companies' activities within the framework of the international ESG agenda. The authors analyze the impact of current factors, such as material and non-material rewards, as well as ensuring the well-being and engagement of employees, on their motivation and satisfaction with working conditions. At the same time, attention is paid to the existing contradictions associated with the influence of modern digital tools, which can play both a supporting and a restraining role in staff motivation. The importance of using digital approaches in conducting analytical work and ensuring the intellectualization and automation of management activities with social and environmental focus within the framework of motivation and incentives is emphasized. In the article, based on empirical and multiple regression analysis, hypotheses about the relationship and mutual influence of motivating factors on the satisfaction and involvement of personnel in the context of digitalization and ensuring sustainable development are formulated and proven. The aim of the study is to assess the impact of motivational factors such as wages, non-material impact, availability of feedback mechanisms, and employee well-being on their engagement and job satisfaction (taking into account the stimulating role of digital tools). Based on this, practical recommendations should be proposed for the management of modern companies on creating the foundations for effective personnel performance in the context of digital transformation and implementation of ESG strategy. Research objectives: 1) to assess the impact of various motivational factors on employee engagement and satisfaction; 2) to analyze the impact of digital tools on motivational factors; 3) to identify the moderating impact of digital tools on motivational factors; 4) to propose recommendations for the formation of motivational factors in the context of digital transformation and sustainable development. The object of the study is employees of modern companies participating in international studies on job satisfaction. Research methods: multiple regression analysis, data analysis, generalization, logical analysis and case study.
Keywords: sustainable development, ESG agenda, management, motivation, staff incentives, digital transformation, mechanism, employee satisfaction, digital tools.

Introduction

Digital transformation today has not only brought about technological innovations, it has also prompted management of organizations to revisit their employee incentives as part of the activation of the ESG agenda. The effectiveness of incentives is directly related to employee motivation and corporate competitiveness, prioritizing sustainable and eco-oriented human development - i.e., the value that an organization creates for its people includes enhancing their health and well-being, skills and employability, quality work experiences, opportunities for advancement, fairness, and a sense of belonging and purpose [1; 2; 3]. This not only helps employees achieve better personal outcomes, but, in a mutually reinforcing process, also contributes to better business outcomes for the organization and for the country as a whole from the positions of sustainable digital development [4, p. 3; 5]. Traditional incentives, such as salary, bonuses and gift offerings are no longer sufficient to meet the needs of the new corporate environment and pooling power brought about by digital transformation. With the application of Artificial Intelligence, Internet of Things and data analytics tools, the problem of optimizing employee incentives through digital means has become an important topic in business management research. Taking this into account, the research topic of this thesis can be considered relevant, especially - taking into account the priorities of the ESG concept.

The results of the authors' analysis of existing scientific publications on this problem and its interpretation in the context of digital transformation allowed them to formulate two contradictory hypotheses (H1 and H2). In the framework of hypothesis H1, we make the assumption that: about significant positive correlation between employee motivation mechanisms, such as salary incentives, spiritual incentives, employee well-being, employee participation as well as positive feedback, and employee engagement. Hypothesis H2 contains the assumption that the use of digital tools has a determined moderating effect on motivation mechanisms.

Research results

With regard to Hypothesis H1, this study used multiple regression analysis to investigate the relationship between motivational factors and employee engagement, using publicly available data from the Gallup and Bureau of Labor Statistics Workplace Survey in the United States from 2014 to 2024.

In this study, data were collected and compared in the following areas:

1. Employee engagement. This category refers to the degree of employee involvement and enthusiasm at work and in the workplace. This study refers to the results of GALLUP's engagement survey Q 12, which tracks the employee engagement of thousands of organizations around the world and measures employees' perceptions of the most critical elements of workplace culture *(Source: GALLUP. Indicator – employee engagement. - URL: https://www.gallup.com/394373/indicator-employee-engagement.aspx. Data accessed 05.11.2024).* Among the survey results, data from the U.S. Employee Engagement Trend from 2016 to 2024 was selected. Current employee needs are gradually shifting towards more responsible work, solving difficult but interesting tasks, etc., which leads to employees wanting to be involved in the company's business and become comprehensive, informed participants in corporate change and development [6, p. 200]. Among other things, this contributes to ensuring the sustainable development of the organization and is in line with the modern environmental management agenda. [7] By involving employees in the organization's decision-making process and management at all levels, employees can feel the trust of their superiors and thus experience a strong sense of responsibility that their interests are closely linked to the development of the organization. In turn, this is closely related to such a modern direction of sustainable development of the organization as talent management [8]. This study refers to GALLUP's research on Leadership & Management and selects the responses of employees in American companies to the question: "Does my manager include me in goal setting?" as the source of data for the variable of employee participation.

2. Spiritual incentives. They are closely related to spiritual motivation, which is considered as an intrinsic, non-material motivation, including respect for employees and recognition of work results. This study refers to GALLUP's survey "The people and planet" *(Source: GALLUP. INDICATORS-ESG: Environmental, Social and Governance. - URL: https://www.gallup.com/395216/indicator-esg.aspx. Data accessed 05.11.2024).* Thus, the responses of employees to the question: "Is there someone at work who encourages my development?" - were selected as the reference data for the variable of spiritual motivation in the survey results.

3. Salary incentives. This kind of incentives refers to the total amount of remuneration that a worker receives for their work. It is worth noting that while remuneration is changing, factors such as prices are also constantly changing. Therefore, it is also necessary to consider the inflation rate in the market to obtain more realistic data on the trend of remuneration growth. This study selected data from 2016 to 2024 on the US wage growth and US inflation rate from the TRADING ECONOMICS websites.

4. Employee well-being. It includes attention to the psychological, physical, emotional and financial health of employees. It provides employees with benefits such as financial support, health assistance, and flexible working hours to help them achieve a better work-life balance and a more positive attitude towards work and the workplace. This study refers to the results of the US employee perceptions of organization caring about their wellbeing from the GALLUP study INDICATORS-Employee Wellbeing *(Source: GALLUP. INDICATORS-Employee Wellbeing. - URL: https://www.gallup.com/394424/indicator-employee-wellbeing.aspx. Data accessed 06.11.2024)* and data from 2014 to 2024 was selected (the question was: "Does my organization care about my overall wellbeing?").

5. Employee feedback: Employee feedback is defined as a communication process in which an employer or supervisor provides constructive comments and evaluations to employees regarding their work performance, behavior (or other aspects), which can help employees understand their own performance. This study refers to GALLUP's research on leadership and management *(Source: GALLUP. INDICATORS-Leadership & Management. – URL: https://www.gallup.com/404252/indicator-leadership-management.aspx. Data accessed: 07.11.2024),* and selects the responses of employees in American companies to the question "Have I received meaningful feedback in the last week?" as the source of data for the employee feedback factor.

The data integration is presented in table 1.

Table 1

Summary of empirical research data on employee motivational factors and engagement*

Variable	Employee engagement, Y	Spirit incentives, X_1	Salary incentives，X_2		Employee well-being, X_3	Employee participation, X_4	Employee Feedback，X_5
Data selection	Employee Engagement Trend (Engaged, %)	«There is someone at work who encourages my development» (Strongly agree, %)	Wage Growth (%)	Inflation Rate (%)	«My organization cares about my overall wellbeing» (Strongly agree, %)	«My manager includes me in goal setting» (Strongly agree, %)	«I have received meaningful feedback in the last week» (Strongly agree, %)
2014, Jan	31.0	31.0	3.68	1.6	25.0	–	–
2015, Jan	32.0	30.0	5.57	–0.1	–	–	21.0
2016, Jan	33.0	32.0	3.55	1.4	–	29.0	23.0
2017, Jan	33.0	31.0	3.7	2.5	–	29.0	21.0
2018, Jan	34.0	32.0	5.6	2.1	–	–	–
2018, Aug	–	–	5.6	2.7	–	25.0	–
2019, Jan	35.0	34.0	4.7	1.6	–	–	–
2019, May	–	–	4.8	1.8	29.0	–	–
2019, Sep	–	–	4.2	1.7	–	29.0	20.0
2020, Jan	36.0	36.0	5.2	2.5	–	–	–
2020, Mar	–	–	2.3	1.5	46.0	31.0	23.0
2020, May	–	–	–2.6	0.1	49.0	–	–
2021, Jan	34.0	–	2.6	1.4	38.0	–	–
2021, Mar	–	35.0	4.3	2.6	36.0	26.0	23.0
2022, Feb	32.0	32.0	10.8	7.9	24.0	–	21.0
2022, Jun	32.0	30.0	7.3	9.1	21.0	–	21.0
2022, Sep	32.0	33.0	8.0	8.2	24.0	24.0	20.0
2022, Nov	33.0	33.0	5.1	7.1	26.0	–	–
2023, Feb	33.0	33.0	5.3	6.0	25.0	–	22.0
2023, May	34.0	34.0	5.9	4.1	24.0	–	24.0
2023, Aug	33.0	32.0	4.9	3.7	24.0	27.0	22.0
2023, Nov	33.0	32.0	5.6	3.1	24.0	–	–
2024, Feb	30.0	29.0	6.8	3.2	21.0	–	19.0
2024, May	32.0	–	7.0	3.3	25.0	–	23.0
2024, Aug	31.0	–	–	2.5	24.0	26.0	21.0

*Developed by the authors based on: GALLUP. Indicator – employee engagement. - URL: https://www.gallup.com/394373/indicator-employee-engagement.aspx; GALLUP. INDICATORS-ESG: Environmental, Social and Governance. - URL: https://www.gallup.com/395216/indicator-esg.aspx; GALLUP. INDICATORS-Leadership & Management. – URL: https://www.gallup.com/404252/indicator-leadership-management.aspx. Data accessed 07.11.2024

In order to study, the relationship between motivational factors and employee engagement, this study uses ordinary least squares (OLS) to construct a multiple factor regression model, establishing the following model equation (1):

$$Y=\beta_0+\beta_1 X_1+\beta_2 X_2+\beta_3 X_3+\beta_4 X_4+\beta_5 X_5+\epsilon \tag{1}$$

Among them: Y – Employee engagement; X_1 – Spirit incentives; X_2 – Salary incentives; X_3 – Employee well-being; X_4 – Employee participation; X_5 – Employee feedback; β_i – regression coefficient, which measures the impact of each motivational factor on employee engagement; ϵ - error term.

In order to better implementation of multiple regression analysis, the data in table 1 needs to be cleaned and processed. For salary incentives, because nominal salary increases may not reflect employees' actual purchasing power and improvement in living standards, the inflation rate in the United States needs to be taken into account to calculate the actual salary increase rate for employees.

In order to calculate the actual wage growth rate, we use the following formula to make adjustments (2):

$$X_2^{real}=X_2^{nominal}-IR \tag{2}$$

Among them: X_2^{real} – Real Salary Growth Rate; $X_2^{nominal}$ – Nominal Salary Growth Rate; IR – Inflation Rate.

Because some data could not be obtained, this study used linear interpolation to simulate the missing data. The processed data is shown in table 2.

Table 2

Statistical table for multiple regression analysis*

Variable	Employee engagement, Y (%)	Spirit incentives, X_1 (%)	Salary incentives, X_2 (%)	Employee well-being, X_3 (%)	Employee participation, X_4 (%)	Employee feedback, X_5 (%)
2016, Jan	33.00	32.00	2.15	26.50	29.00	23.00
2017, Jan	33.00	31.00	1.20	27.25	29.00	21.00
2018, Jan	34.00	32.00	3.50	28.00	26.47	20.62
2018, Aug	34.58	33.16	2.90	28.44	25.00	20.41
2019, Jan	35.00	34.00	3.10	28.75	26.55	20.25
2019, May	35.33	34.66	3.00	29.00	27.76	20.13
2019, Sep	35.67	35.33	2.50	35.86	29.00	20.00
2020, Jan	36.00	36.00	2.70	42.66	30.34	22.01
2020, Mar	35.67	35.86	0.80	46.00	31.00	23.00
2020, May	35.34	35.72	-2.70	49.00	30.16	23.00
2021, Jan	34.00	35.14	1.20	38.00	26.81	23.00
2021, Mar	33.70	35.00	1.70	36.00	26.00	23.00
2022, Feb	32.00	32.00	2.90	24.00	24.77	21.00
2022, Jun	32.00	30.00	-1.80	21.00	24.34	21.00
2022, Sep	32.00	33.00	-0.20	24.00	24.00	20.00
2022, Nov	33.00	33.00	-2.00	26.00	24.55	20.80
2023, Feb	33.00	33.00	-0.70	25.00	25.37	22.00
2023, May	34.00	34.00	1.80	24.00	26.17	24.00
2023, Aug	33.00	32.00	1.20	24.00	27.00	22.00
2023, Nov	33.00	32.00	2.50	24.00	26.75	20.50
2024, Feb	30.00	29.00	3.60	21.00	26.50	19.00

* Developed by the authors based on: GALLUP. Indicator – employee engagement. - URL: https://www.gallup.com/394373/indicator-employee-engagement.aspx; GALLUP. INDICATORS-ESG: Environmental, Social and Governance. - URL: https://www.gallup.com/395216/indicator-esg.aspx; GALLUP. INDICATORS-Leadership & Management. – URL: https://www.gallup.com/404252/indicator-leadership-management.aspx. Data accessed 07.11.2024

This allows us to conduct correlation analysis based on calculation the Pearson correlation coefficient (*r*) between the independent and dependent variables for preliminarily assess the linear relationship between them. In addition, we should use the variance inflation factor to detect whether there is multiple collinearity between the independent variables.

The calculation results are shown in table 3.

Table 3

Correlation parameters between variables*

	Spirit incentives, X_1	Salary incentives, X_2	Employee well-being, X_3	Employee participation, X_4	Employee feedback, X_5
Pearson correlation coefficient, r	0.8668	0.0768	0.7535	0.6111	0.3160
Variance inflation factor *(VIF)*	3.95	1.41	6.78	2.93	1.50

*Developed by the authors

Based on the data, it can be inferred that there is a strong positive correlation between spiritual incentives (X_1) and employee well-being (X_3) - and employee engagement (Y), indicating that these two factors play a significant role in enhancing employee engagement. Salary incentives (X_2) have a very weak effect on employee engagement, indicating that increasing salary incentives alone is not an effective way to increase employee motivation. Employee well-being (X_3) has a high *VIF* value (6.78), indicating some degree of collinearity, but it does not exceed the threshold of 10, so the model still has a certain degree of robustness and explanatory power.

The results of the regression analysis will be presented further, in tables 4, 5 and 6.

Table 4

Overall effect parameters of the regression model (Model Summary)*

Model	R	R^2	Adjusted R^2	Standard error of the regression, %
1	0.910*a*	0.828	0.770	0.72997

Here: a - Predictor variable: constant, employee motivational factor X_i
*Developed by the authors

Table 5

Regression ANOVA table (*a*)*

Model		Square sum	Degree of freedom	Mean square	F	Significance (*p*)
1	Regression	38.432	5	7.686	14.425	<0.001*b*
	Residual	7.993	15	0.533		
	Total	46.425	20			

Here: a - Dependent variable *Y*
  b - Predictor variable: constant, employee motivational factor *X*i
*Developed by the authors

Table 6

Regression coefficients and significance coefficient test table Coefficients (*a*)*

Model		Non-standardized regression coefficient		Standardized regression coefficient	t	Significance (*p*)
		β	Standard error	β		
1	Constant	7.096	6.037		1.175	0.258
	Spirit incentives, X_1	0.722	0.166	0.926	4.349	<0.001
	Salary incentives, X_2	0.025	0.103	0.030	0.240	0.814
	Employee well-being, X_3	-0.037	0.052	-0.197	-0.705	0.492
	Employee participation, X_4	0.258	0.135	0.351	1.196	0.075
	Employee feedback, X_5	-0.155	0.148	-0.138	-1.050	0.311

Here: *a* - Dependent variable *Y*
*Developed by the authors

Therefore, we can conduct a model result analysis:

R^2 is used to assess the goodness-of-fit of the overall regression model, with a value closer to 1 indicating a more pronounced linear relationship. As shown in Table 4, the $R^2 = 0.828$ indicates that the model can explain 82.8% of the variance in employee engagement, indicating a high model fit.

The adjusted $R^2 = 0.770$ indicates that after considering the complexity of the model, the explanatory power of the independent variables on the dependent variable has slightly decreased, but it is still highly explanatory.

The F-test is used to assess the overall significance of the regression model, meaning the significance of all independent variables in explaining the dependent variable. As shown in Table 5, the F value 14.425 ($p = 2.83e$-05) indicates that the model as a whole is significant, and the overall effect of all independent variables on the dependent variable is statistically significant. Therefore, the combination of independent variables is effective in explaining the dependent variable (employee engagement).

No less important is the analysis of the significance of regression coefficients. The t-test is used to assess the significance of individual variable coefficients, with the p-value serving as the measure of significance. As shown in Table 6, if the p-value is less than 0.05, it indicates that the independent variable has a strong explanatory power for the dependent variable.

Spiritual incentive (X_1): regression coefficient equal to 0.722 ($p < 0.05$) indicates that spiritual incentive is statistically significant. The high regression coefficient indicates that spiritual incentive has a positive effect on employee engagement and has a relatively large impact. In other words, spiritual incentive is the recognition and support that employees perceive. This can effectively enhance their work enthusiasm. Salary incentives (X_2): regression coefficient equal to 0.025 ($p = 0.814$) indicates that salary incentives have no significant independent effect on employee engagement. Although salary increases can motivate employees in the short term, in the long term, salary may not significantly affect employee engagement alone. This is especially true given that not only the United States, but the global economy is currently volatile, and even a "large salary increase" cannot cope with inflation. An increase in employee salary does not necessarily improve their lives. However, according to a Gallup survey on employee retention and attraction *(Source: GALLUP. INDICATORS-Employee Retention & Attraction. – URL: https://www.gallup.com/467702/indicator-employee-retention-attraction.aspx. Data accessed 07.11.2024)* in 2024, the proportion of employees leaving their jobs due to salary and benefits issues reached 12%, which was the highest reason in the questionnaire statistics. In turn, when choosing to accept a new job, as many as 58% of people consider 'Significantly increases my income or improves my benefits package' to be very important. Therefore, salary incentives are still an important factor that cannot be ignored.

Employee well-being (X_3): the negative regression coefficient and p-value greater than 0.05 indicate that the independent effect of employee well-being on engagement is not statistically significant. The reason is that the data selected for the study, employees' responses to the question of whether the company cares about their well-being, may lack certain explanatory power, and the statistical results may be related to a mismatch between employees' expectations and the actual benefits provided by the company. Employee participation (X_4): The regression coefficient is 0.2583, with $p = 0.075$, close to significant level. This means that employee participation has a positive impact on employee engagement to some extent, but the data does not fully support this. Employees' sense of participation in goal setting and company decision-making may first of all help to enhance their sense of belonging and responsibility, which in turn affects employee engagement.

Employee feedback (X_5): The regression coefficient is negative, and the p-value is relatively large, indicating that the independent effect of employee feedback on engagement is not significant and may even have a negative effect. The negative regression coefficient indicates that the current general feedback method led by leaders may be problematic, and employees may perceive the feedback as lacking constructiveness or feel that the feedback does not sufficiently respect their personal contributions. Thus, the standard regression equation obtained is the next (3):

$$Y = 7.096 + 0.722\,X_1 + 0.025\,X_2 - 0.037\,X_3 + 0.258\,X_4 - 0.155X_5 \qquad (3)$$

To summarize, we can assume that part of the Hypothesis H1 we formulated above has been partially verified. The positive impact of spiritual incentives on employee engagement has been significantly verified, and employee engagement shows a positive correlation with employee engagement. Salary incentives and employee well-being have a loose relationship with employee engagement and do not show a strong trend.

In addition to the above motivational factors, in the current complex context of digital transformation, companies should also consider employee career development, teamwork, work flexibility and autonomy, innovation opportunities, fairness and transparency, cultural and value identity, working environment and tool support, and many other factors when establishing incentive mechanisms. Motivating employees from multiple perspectives provides strong support for companies to maintain competitiveness in the digital transformation. Regarding Hypothesis H2 (see above) we should mention firstly the moderating effect of digital tools on the incentive mechanism. Because it is currently impossible to obtain a large amount of mutually matching and highly correlated data to accurately verify using mathematical models, this study uses comparative analysis, case studies and empirical data to discuss and verify the hypothesis.

Digital skills can lead to higher pay, job satisfaction and security for employees. According to a study conducted by Amazon Web Services and Gallup in collaboration with more than 30,000 workers and 3,000 hiring managers in 19 countries, the more digital skills an employee has, the higher their income, the more satisfied they are with their employment situation, and the higher their job security [9]. There is a strong correlation between the extent to which digital skills are used and job satisfaction. 64% of employees who have mastered five or more digital skills rate their job as good, compared to 56% of those who have mastered three skills, 40% of those who have mastered one skill and 37% of those who have no

digital skills. The effectiveness of spiritual incentives can be enhanced by using digital tools. So, Google uses internal social platforms such as Google+ to praise and recognize employees' achievements and foster a positive culture. Using digital tools such as online Q&A platforms, management can regularly communicate with employees online to answer various questions raised by employees [10, p. 283]. This transparent communication makes employees feel valued and supported by the company, and also enhances their sense of belonging and self-worth.

Numerous digital platforms enhance employee engagement. For example, IBM has developed the online collaboration platform ThinkPlace, where employees can submit ideas, collaborate with other employees, and even suggest improvements to the company's strategy, including ESG [11, p. 105]. More than 100,000 employees use ThinkPlace to submit suggestions within IBM, and the company adopts about 10% of the suggestions each year. This participation mechanism not only increases employees' influence on the decision-making process, but also enhances their sense of belonging to the company.

Digital tools can help to rationalize working hours and tasks. For example, Microsoft's MyAnalytics tool can summarize an employee's time allocation at work and then propose smarter ways of working – from reducing useless meeting time to reducing out-of-office working hours. It can even use artificial intelligence (AI) to help employees keep track of their To-Do list and mark the commitments they make in emails [12, p. 344], which significantly enhances employees' sense of work-life balance with the support of digital tools.

Digital tools also have a direct impact on productivity and employee satisfaction. A typical example is Sociometric Solutions, a spin-off from the Massachusetts Institute of Technology, which provides ID badges with built-in Bluetooth sensors and analytics tools to track employee behavioral data and generate insights to improve productivity. A call center at Bank of America used the system to track colleagues for three months and found that putting certain employees together to take breaks and share customer service tips increased productivity and employee satisfaction by an average of 15–20% [13].

Technological advances have also improved employers' learning and training programs, making them more personalized, adaptable and scalable. For example, ADP StandOut, ADP's cloud-based coaching platform, uses machine learning software to provide managers with personalized strategies to help them develop their employees' strengths [13, p. 2]. Salesforce provides skills training for employees through the Trailhead learning platform, which gamifies learning content. Employees learn new skills by completing courses, earning badges and points, which increases their interest in learning and makes them feel more accomplished [14]. This, in turn, has a powerful motivating effect on staff, creating higher-level needs for both individual workers and work teams. This relationship has been noted by many scientists, from the classics of 20th century management who contributed to the concept of behaviorism to modern researchers [15; 16; 17, p. 103].

Digital tools provide employees with more choices in the way they work. Referring to Gallup's research on INDICATORS-Hybrid Work (see figure 1), we can see that since the COVID-19 pandemic triggered a wave of telecommuting and hybrid work, the employee engagement of purely remote and hybrid employees has been much higher than that of on-site employees.
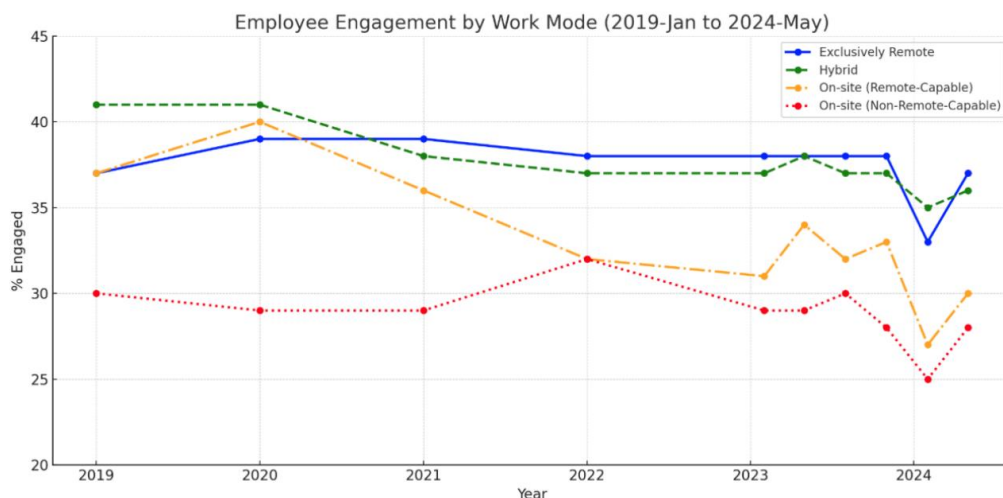

Figure 1. Employee engagement among US full-time employees
(Source: GALLUP. INDICATORS-Hybrid Work. –
URL: https://www.gallup.com/401384/indicator-hybrid-work.aspx (data accessed 09.11.2024)

The study also found that in a survey of American employees in 2023, the number of people who chose that hybrid work had advantages was two to three times higher than the number of people who chose that hybrid work brought

challenges. 76% of employees believe that the hybrid work system has improved work-life balance. 52% of employees believe that work efficiency has been improved. Therefore, the proper use of telecommuting systems and digital tools can bring greater flexibility and freedom to employees' work, thereby improving employee satisfaction and work efficiency.

In summary, we could constant that Hypothesis H2 was confirmed. Although the hypothesis was not confirmed by mathematical modeling, it can be seen from the case study and empirical data that digital tools enhance employee recognition and a sense of belonging in terms of spiritual incentives. The use of digital tools and platforms has improved the effectiveness of incentives in terms of salary incentives, employee engagement, and employee feedback. Digital tools provide employees with more opportunities for learning and development. They also significantly improve employees' perception of work-life balance, giving them more autonomy and flexibility at work. Digital tools can therefore be said to play a significant moderating role in employee motivation.

The following recommendations are based on the results of the empirical research and are aimed at companies establishing incentive mechanisms in the context of digital transformation:

1. Introduce a digital feedback system, using an intranet social platform or real-time feedback tool to provide employees with recognition and timely and effective feedback in an open and transparent manner, enhancing their sense of self-worth and belonging.

2. Use digital analysis tools to optimize performance evaluation and management, improve the fairness of incentive mechanisms, enhance employees' trust in the organization, and thus promote engagement.

3. Provide employees with personalized development and training opportunities through a personalized learning platform to stimulate their intrinsic motivation, enhance their sense of achievement and drive for career development.

4. Use intelligent analysis tools to help employees optimize working hours, reduce ineffective meetings, balance work and life, relieve employee stress, and improve their sense of well-being and productivity.

Discussion

Despite this study has thoroughly explored the effectiveness of digital incentives, there are still some shortcomings. First, data collection is mainly based on case studies and existing empirical data, and there is a lack of large-scale, systematic quantitative data support, which may affect the general applicability of the results. Second, the study fails to comprehensively cover other potential motivational factors, such as teamwork and innovation incentives.

In the future, large-scale empirical studies can be conducted to collect more systematic data to verify the effectiveness of digital incentives in different contexts. Explore the differences in digital incentives across cultures and industries. This will provide theoretical support for companies to build a more comprehensive incentive system in the process of digital transformation.

Conclusion

This study analyzed the impact of various motivational factors on employee engagement and satisfaction in the context of digital transformation and sustainable digital development. It assessed the effectiveness of salary incentives, spiritual incentives, employee well-being, employee participation, and feedback mechanisms, and explored the moderating role of digital tools.

The results show that spiritual incentives significantly enhance employees' enthusiasm and sense of participation at work, and that employee participation also has a strong positive impact on engagement. In contrast, salary incentives and employee well-being have a weaker independent impact, indicating that salary increases or welfare investments alone are no longer sufficient to significantly enhance employee motivation. According to the authors, this can be considered as one of the characteristics of the current stage of ESG development, when non-material motivational factors come to the fore, reflecting the contribution of each employee to the achievement of common goals. Companies should establish personalized incentives, while at the same time optimizing the content and methods of feedback to make it more constructive and motivating. Digital tools play a significant moderating, and, in the same time, not always straightforward, role in the incentive mechanism. This allows us conclude that modern companies should integrate them more closely into the incentive system to maximize the effect of supporting sustainable digital development.

Литература (References)

1. *Schwartz J, Eaton K., David Mallon D.* The worker-employer relationship disrupted: If we're not a family, what are we? Deloitte Insights. 2021. [Electronic resource]. URL: https://www2.deloitte.com/us/en/insights/focus/human-capital-trends/2021/the-evolving-employer-employee-relationship.html (data accessed 05.11.2024).

2. *Pandey M.K.* A bibliometric review of scientific research on the significance of information technology relating to sustainable development reporting practice / M. K. Pandey, A. K. Pathak, I. G. Sergeeva // Biznes-Informatika. 2023. Vol. 17. No. 4. pp. 94–112. – DOI 10.17323/2587-814X.2023.4.94.112.

3. *Измайлов М.К., Пупенцова С.В.* Тенденции внедрения элементов концепции ESG в систему менеджмента отечественных предприятий // Научный журнал НИУ ИТМО. Серия: Экономика и экологический менеджмент. 2024. № 1. С. 42–50. DOI 10.17586/2310-1172-2024-17-1-42-50.

4. *Commisso C., Kumar Saha A., Downey E., et al.* Global Human Capital Trends Report 2024. Deloitte Insights. 2024. p. 120. [Electronic resource]. URL: https://www2.deloitte.com/us/en/insights/focus/human-capital-trends.html (data accessed 05.11.2024).

5. Vashkevich N., Barykin S.E., Krasnov A. [et al.] E-government based on sustainable digitalization: The case of the Chinese social sustainability marketing technologies paradigm // Journal of Infrastructure, Policy and Development. 2024. Vol. 8. No. 3. DOI 10.24294/jipd.v8i3.3113. HJVBCA.

6. *Kharlamov* A., *Kharlamova T.* Human capital development in the digitalization risk management process. Atlantis Highlights in Computer Sciences: Proceedings of the International Conference on Digital Technologies in Logistics and Infrastructure (ICDTLI 2019), Saint Petersburg, 2019, April, 04–05. Atlantis Press. 2019. vol. 1. pp. 199–203.

7. *Калинина О.В., Васильев А.С.* Современные методы поддержания устойчивого развития организации // Экономика и управление: проблемы, решения. 2024. Т. 5. № 3(144). С. 13-19. DOI 10.36871/ek.up.p.r.2024.03.05.002.

8. *Kharlamova T.L., Yuxian Yu., Wenye Zh.* Talent development strategy during the digital transformation of organizations // Петербургский экономический журнал. 2023. –No. 4. Pp. 123–131.

9. *Marken St., Rothwel J.* Digital Workers Find Higher Pay, Job Satisfaction, Security. Gallup. [Electronic resource]. URL: https://news.gallup.com/poll/402920/digital-workers-find-higher-pay-job-satisfaction-security.aspx (data accessed 08.11.2024).

10. *Bock L.* Work Rules! Insights from Inside Google that Will Transform how You Live and Lead. John Murray, 2015. – p. 406.

11. *Majchrzak A., Cherbakov L. & Ives B.* Harnessing the Power of the Crowds with Corporate Social Networking Tools: How IBM Does It. MIS Quarterly Executive. 2009. 8 (2). pp. 103-108.

12. *Winikoff M., Cranefield J., Li J., Richter A. and Doyle C.* The Advent of Digital Productivity Assistants: The Case of Microsoft MyAnalytics. 54th Annual Hawaii International Conference on System Sciences (HICSS 2021) At: Kauai. 2021. pp. 338–327. DOI 10.24251/HICSS.2021.040.

13. *Keller S., Moles K., Schaninger B.* TalentTech：Talent empowerment in the digital age. McKinsey＆Company. [Electronic resource]. – URL: https://www.mckinsey.com/capabilities/people-and-organizational-performance/our-insights/the-organization-blog/talenttech-enabling-talent-in-the-digital-age (data accessed 09.11.2024).

14. *Patnaik R.* Enhancing Salesforce Expertise: The Impact and Evolution of Trailhead Training. J Artif Intell Mach Learn&Data Sci. – 2022. – 1(1). – pp. 529-532. – DOI 10.51219/JAIMLD/raja-patnaik/141.

15. *Харламова Т.Л., Алексеева Н.С.* Исследование взаимосвязи между человеческим капиталом и инновационным развитием // Социально-экономический и гуманитарный журнал. 2021. № 4(22). С. 63-76. DOI 10.36718/2500-1825-2021-4-63-76.

16. *Ергунова О.Т., Сомов А.Г., Бышевская А.В.* Интеграция методов искусственного интеллекта в образовательную сферу: возможности и подходы // Научное обозрение. Серия 2: Гуманитарные науки. 2024. № 9. С. 95–107. DOI 10.26653/2076-4685-2024-09-09.

17. Бездудная, А.Г., Растова Ю.И., Львин Ю.М. Обратное наставничество как корпоративная социальная инновация: проблемы и возможности // Известия Санкт-Петербургского государственного экономического университета. 2023. № 1(139). С. 101–105.