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СОВРЕМЕННЫЕ ТРЕБОВАНИЯ ЭКОНОМИЧЕСКОГО ВОСПИТАНИЯ УЧАЩИХСЯ НА УРОКАХ ТЕХНОЛОГИИ

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***Аннотация**: В настоящее время интеграция знаний из различных областей науки в рамках единой дисциплины – «Технология» способствует более успешному научению школьников решению проблем экономического воспитания. Преимущество данной интеграции закладывается в возможности многоаспектного рассмотрения изучаемых объектов, явлений, процессов. Исследование их одновременно под углом зрения нескольких областей знания (экономики, технологии, экологии) позволяет более глубоко проникнуть в суть изучаемого и одновременно осознавать целостность окружающего мира.*

***Ключевые слова:** Экономика, исследование, кадры, промышленность, производство, импортозамещение, экспорт, импорт, деиндустриализация, капитал.*

***Key words:** Economy, research, personnel, industry, production, import substitution, export, import, deindustrialization, capital.*

Возрастающая роль интеллектуального потенциала Республики Таджикистан в конкретных отношениях на мировом рынке привели к неудовлетворенности качеством экономической подготовки учащихся, к неподготовленности выпускников к новым социально-экономическим отношениям в условиях, когда страна живет в режиме форсированного индустриально-инновационного развития и экономика страны нуждается в трудовых ресурсах.

В настоящее время государство поставило перед системой образования задачу, которая заключается в подготовке выпускников, способных осуществить глубокие изменения в экономике страны связанные с новыми социально-экономическими условиями, жить и трудиться в нынешних условиях [11;67]. По результатам анализа государственного образовательного стандарта, учебных планов и программ выявлено, что сегодня с одной стороны, в общеобразовательных школах нет специального предмета, который вооружил бы учащихся экономической грамотностью, теоретически и практически подготовил их к трудовой деятельности. С другой стороны, имеющиеся в учебниках сведения по экономической подготовке, давно устарели и не отвечают современным требованиям[10;54].

Совершенствование экономического образования и воспитания в семье, с одной стороны, требует улучшения экономической подготовки родителей, а с другой укрепления связи школы, семьи и производственных коллективов.

Современные проблемы экономического воспитания тесно связаны с его историей.

По убеждению К.Д. Ушинского воспитание должно быть способным определить свое положение в хозяйственной сфере. Отсюда он призывает овладевать наукой хозяйствования, где действуют законы политэкономии, потому что она как «наука хозяйства должна вывести обыкновенного человека на ту высоту, с которой, прежде всего только один гений угадывал хозяйственные потребности народа и возможности их удовлетворения» [12;348].

Педагогическая система К.Д. Ушинского, основывается на связи педагогики с другими науками: анатомией, физиологией, психологией, логикой, географией, статистикой, политэкономией, историей. «Во всех этих науках излагаются, считаются и группируются факты и те соотношения фактов, в которых обнаруживаются свойства предмета воспитания, т.е. человека» [12;349]. Здесь речь идёт о системе знаний, которую обязан, усвоить педагог, во избежание односторонней в воспитании. В эту основу учитель непременно включает экономические знания.

По мнению Н.К. Крупской школа должна быть связана с экономической жизнью страны и местности в частности. В связи с этим она пишет: «Политехнизм – это целая система сюда входит и изучение географической основы экономических отношений, влияние способов добывания и обработки на общественные формы труда и влияние последних на весь общественный уклад» [3;559]. Главной задачей школы она считает понимание учащимися элементов производства и механизмов взаимоотношений одной сферы производства с другим.

Политехническое образование связывает со знанием экономических законов и организации производства.

Н.К.Крупская уделяет пристальное внимание воспитанию бережного отношения к собственности, изучению основ научной организации труда и проблемам выбора профессии.

Педагогическое наследие А.С. Макаренко большое значение имеет для научного осмысления проблемы экономического образования и воспитания. Представляя цель воспитания как конкретную программу личности, А.С. Макаренко отводит большое место воспитанию сознательного хозяина страны: «У нас каждому человеку предстоит в жизни обязательно участвовать в общем государственном хозяйстве, и чем лучше он будет подготовлен к этому делу, тем больше он принесёт пользы и всему обществу и самому себе» [6;511].

Положение А.С. Макаренко о воспитании как процессе, имеющим социально – экономические предпосылки является методологическим: «Со всем сложным миром окружающей действительности ребёнок входит в бесконечное число отношений, каждое из которых неизменно развивается, переплетается с другими отношениями, усложняется физическим и нравственным ростом самого ребёнка».

Рассматривая, экономическую и педагогическую эффективность труда А.С. Макаренко отмечает, что труд, не создающий материальные ценности, не оказывает положительного влияния на воспитание. С другой стороны он подчеркивает, что необходимо труд организовать педагогически. Он отмечает экономическое и педагогическое значение хозрасчёта, называя его замечательным педагогом.

Благодаря нему воспитанники ощущали реальные результаты труда, хозяйственные заботы, учились хозяйствовать. «Сделав Хозяйственную заботу отправной точкой в процессе воспитания, мы в полной мере с теорией исторического материализма, все формы нашей жизни и формации вывели из хозяйства и хозяйствования» [6;117].

В работах А.С. Макаренко главное внимание уделяет вопросам бережного отношения к материальным ценностям. На этой основе формируется сознательное отношение к собственности.

Все формы организации жизнедеятельности детей заключены в единую систему режим жизнедеятельности коллектива, который учит точности, аккуратности, экономии времени. Режим понимается как средство воспитания, он в значительной мере способствует воспитанию осознанной дисциплины. Большую роль в осуществлении режима играет самоуправление. Его организация является важным резервом экономического воспитания.

По мнению А.С. Макаренко, в семье в процессе выполнения хозяйственных работ ребёнок, проявляет заботу не только о личных вещах, но и коллективного пользования, участвует в эффективном расходовании семейного бюджета, учится обращаться с деньгами.

А.С. Макаренко рассматривает формирование разумных человеческих потребностей с социально – экономической точки зрения: «Потребность у нас есть родная сестра долга, обязанности, способностей, это проявление интересов не потребителя общественных благ, а создателя этих благ» [6;373]. Он обращает внимание на необходимость воспитания таких важных качеств хозяина – гражданина, как бережливость, точность, оперативность, деловитость.

Немаловажную роль в формировании у учащихся трудовых навыков играют родители и старшие в семье. Они должны помочь детям выбрать правильный путь, который бы соответствовал требованиям общества, а также склонностям и возможностям детей, при

выборе профессии. Но не всегда учитывается желание ребенка, его способности. Ведь выбор профессии определяет будущую трудовую деятельность. В трудовом и идейном воспитании учащихся выбор специальности являются не только социально-экономическим фактором, но и должны учитываться желание и воля ребенка. В этом плане учащиеся в процессе последующей трудовой деятельности трудовом воспитании должны были приобрести трудовые навыки. Родители обязаны познакомить своих детей с разными видами профессий и разъяснять их значение. Но в настоящее время встречаются такие родители, которые не желают изучать психологические особенности своих детей, поэтому мы считаем целесообразным предложить родителям психолого-педагогические советы и рекомендации[4;704].

Выбор профессии требует специальной подготовки и является трудной и ответственной задачей. Поэтому задача родителей при выборе профессии очень важна, так как они лучше всех знают желания и интересы своих детей. В семье появляются первые трудовые навыки, которые играют большую роль в трудовом воспитании детей. Главная задача семьи заключается в том, чтобы подготовить детей как будущих граждан общества и строителей новой жизни. С этой целью родители должны воспитывать и способствовать детей в формировании у них таких экономически значимых качеств, как трудолюбие, стремление трудиться на благо общества.

Развитие человека в обществе связано с ростом развития семьи и семейных отношений, а также сохранению сугубо традиционных отношений. Именно народная традиция объединила людей в обществе, показала и регламентировала все действия и поступки, что члены первобытного рода не имели представления о случайности. В настоящее время наряду с традициями и обычаями, утверждается и гражданское право регулирующее отношение между людьми и членами семьи. В каждом обществе каждая народная традиция оценивается как[8;176]:

-во–первых, народная масса является движущей силой всех социальных изменений, ибо народ является хранителем и создателем традиций;

-во-вторых, народные традиции, которые прошли через человеческое сознание, открыли путь к духовным фактором в общественно- политическом и социально-экономическом развитии.

Многовековая история таджикского народа выработала традиции и обычаи, обусловленные конкретно историческими, социально-экономическими условиями жизни. Самыми яркими и лучшими из них является трудолюбие, уважение старших, уважение к хлебу, скромность, любовь к народу, к Родине, к матери, гостеприимство и т.д [9;108].

Прославился таджикский народ с давних времен своими традициями в различных областях искусства, музыки, архитектуры, ювелирным и гончарным искусством, а также золотошвейным промыслом и земледелием.

Если предполагать, что эти традиции присуще только таджикскому народу, то мы ошибаемся[5;157].

Ведь эти традиции и обычаи также свойственны узбекам, татарам, казахам и туркменам. Народные традиции и обычаи определяют ряд факторов, которые обуславливают общность педагогической культуры:

- во - первых, определяют общность исторического условия, а также цели и интересы всех народов и народностей[2;134];

- во-вторых, психологию всех регионов и географических условий;

- в – третьих, взаимовлияние и взаимодействие народной педагогики и народной традиции с обычаями разных народов, а также отраслей педагогической науки (специальная педагогика, возрастная и педагогическая психология и др.).

Они выступают своеобразными формами национальной и семейных отношений быта, культуры того или иного народа, живущих рядом веками на одной земле.

У всех национальностей взаимная помощь является одним из лучших народных традиций. Каждый раз при выполнении трудной работы требующий усиленную работу, люди объединяются вместе и совместно завершают эту работу. Если у русских это принято назвать «помощью», то у туркменов, таджиков и узбеков называется «хашар»[1;143].

В современном обществе в быту таджиков существует немало народных традиций, сформировавшихся на основе народных обычаев, явившихся результатом преобразования старых обычаев в условиях демократического общества.

ЛИТЕРАТУРА

1. Исоев С. Опыт и народные традиции в трудовом воспитании детей в семье: дис.канд.пед.наук\.Исоев Саидахмад.-1983.-143с.
2. Кадыров,К. Дидактические аспекты применения информационных технологий обучения в вузе\. К.Кадыров.-Душанбе:2006.-134.
3. Крупская,Н.К. Педагогические сочинения: в 6т.Т.3\ Н.К. Крупская;под ред. А.М. Арсеньева и др.-М.: педагогика.-559с.
4. Лутфуллоев,М. Национальная педагогика таджикского народа\.М.Лутфулоев.- Душанбе, 2015.-704 с. (на тадж.яз.).
5. Маджидова, Б. Традиции таджикского народа в формировании нравственных качеств личности\.Б.Маджидова- Душанбе: ТГПУ им. Джураева, 2004. -157с.
6. Макаренко, А.С. Сочинения: В7т. Т.5\.А.С.Макаренко.2-е изд.-М.,1957.-511-373с.
7. Макаренко, А.С. Сочинения: В7т. Т.4\.А.С.Макаренко.2-е изд.-М.,1957.-552-117с.
8. Мосина, А.В. Трудовое воспитание в процессе обучения физике на современном этапе развития советской школы: дис. канд. пед.наук\.А.В,Мосина- Л., 1986.-176 с.
9. Национальная концепция образования Республики Таджикистан. -Душанбе: Матбуот, 2003.-108с.
10. Стратегия Республики Таджикистан в области науки и технологии на 2011-2015 годы.- Д.:2011.-54с.
11. Учебные планы общеобразовательных школ Таджикистана на 2009-2010 гг.- Душанбе, 2009.-67 с.

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CONFLICT BURNOUT IN THE DIGITAL AGE: ORGANIZATIONAL CONFLICT AS A FACTOR OF PROFESSIONAL MALADDAPTATION

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Abstract: *This article analyzes conflict-based burnouta new type of professional maladjustment arising in the context of digital transformation in organizations. It is shown that in the digital age, burnout is increasingly systemic rather than individual in nature and is caused by a contradiction between the formalized logic of algorithmic management, KPI systems, and automated control, on the one hand, and the actual content of professional activity, on the other.*

The article describes the transition of organizational conflict from interpersonal to systemic ("unaddressed"), the paradox of "effective burnout" (high rates with internal alienation), the stages of development of conflict burnout and its managerial consequences: distortion of HR analytics, pseudo-efficiency, loss of initiative, "quiet" turnover.

A conceptual diagnostic model of the Digital Conflict Burnout Index (DCBI) is proposed to assess conflict tension at the level of the organization's digital management architecture.

Key words: *conflict burnout, digitalization, algorithmic management, organizational conflict, KPI, professional maladjustment, HR analytics, DCBI.*

Digital transformation has become a key characteristic of modern organizational development. Digital HR platforms, electronic document management systems, performance calculation algorithms, KPI matrices, and automated control tools are being implemented in virtually all areas of work [1,2,3]. These solutions are positioned as a means of increasing the transparency, controllability, and objectivity of management decisions. However, as they spread, it is becoming increasingly clear that digitalization not only simplifies processes but also creates new, previously poorly described forms of organizational tension [4,5].

Classic studies of professional burnout have focused primarily on emotional exhaustion, stress, overload, and the individual psychological resources of the worker. Conflict has typically been viewed in an interpersonal context—as a clash of interests between employees, managers, or departments. In the context of digitalization, this perspective is proving insufficient. Increasingly, workers are confronted not with "human" conflict, but with contradictions inherent in the very logic of digital management systems [6-8].

Algorithmic management, based on metrics, regulations, and automated scenarios, transforms the nature of organizational conflict. An employee may formally comply with all system requirements, demonstrate high performance indicators, and yet experience persistent internal tension, a sense of injustice, and a loss of professional meaning. Conflict in this case has no specific target: it arises between actual work practices and formalized digital metrics, between responsibility and authority, between demands for flexibility and the rigidity of algorithmic control [2,5].

As a result, a special condition develops, known as conflict burnout in the digital age. Its unique characteristic is that burnout develops not in spite of formal effectiveness, but often in parallel with it [9,10]. Employees continue to meet metrics, comply with regulations, and demonstrate loyalty to the system, but simultaneously experience professional maladjustment, decreased engagement, and a buildup of latent resistance. This makes conflict burnout difficult to diagnose and especially dangerous for organizations focused on digital performance.

In classical theories of management and organizational behavior, conflict was traditionally viewed as the result of a clash of interests between actors—individual employees, managers, departments, or professional groups [11,12]. Sources of conflict included resource distribution, differences in goals, role expectations, management styles, and the personal characteristics of participants. Even in structural approaches, conflict retained a "human face": behind it were always specific actors, decisions, and forms of interaction.

The digitalization of organizations is significantly changing this logic. With the introduction of digital HR systems, algorithmic control mechanisms, and standardized performance metrics, conflict is increasingly no longer a consequence of direct interaction between people. It is shifting to the level of management systems, in which rules, requirements, and assessments are set not individually but through digital interfaces, metrics, and automated scenarios [2,4,5].

In a digital organization, employees encounter not so much the will of a specific manager as the predetermined logic of the system: KPIs, ratings, dashboards, regulations, approval and control algorithms. At the same time, the system itself is positioned as neutral and objective, which deprives conflict of its usual addressee. The resulting contradiction is "blurred": formally, there is no entity with whom to engage in dialogue, discuss a discrepancy, or challenge a decision [1,13].

This shift fundamentally changes the nature of organizational conflict. While in the interpersonal model, conflict presupposes the possibility of negotiation, compromise, or management intervention, systemic conflict, embedded in digital architecture, is reproduced automatically. It is independent of the intentions of individual managers and can persist even despite formally correct management actions.

A characteristic feature of systemic conflict in the digital environment is its normalization. Contradictions between the real logic of work and digital requirements are perceived as a "given," an inevitable consequence of digital transformation. Workers are asked to adapt to the system, not the system to the complexity of work. As a result, conflict is not eliminated but becomes a background condition in the organizational environment.

Digital HR systems are initially designed as tools for streamlining personnel management. Their key objective is to standardize processes, reduce the subjectivity of management decisions, and increase the transparency of performance evaluation. KPI matrices, automated timekeeping systems, electronic regulations, and monitoring algorithms are positioned as neutral and universal solutions applicable to a wide range of professional roles [3,5].

However, in real organizational practice, it is precisely this universality that becomes a source of persistent conflict. Digital HR systems rely on formalized performance parameters and inevitably reduce the complexity of work to a limited set of indicators. As a result, a gap arises between what the system measures and what the employee's actual professional contribution is.

One of the key sources of conflict is the misalignment of digital metrics with the actual content of work. Performance indicators often focus on quantitative parameters, ignoring context, decision quality, cross-functional collaboration, and informal elements of the job. Employees find themselves in a situation where the performance of professionally significant tasks is either not reflected in KPIs or directly impacts formal performance indicators. This creates an internal conflict between professional logic and the logic of the performance evaluation system.

Additional tension is created by the simultaneous demands for flexibility and strict adherence to digital regulations. On the one hand, employees are expected to be proactive, adaptable, and responsible for results. On the other hand, digital systems impose rigid action scenarios, limit decision

variability, and minimize the scope for professional judgment. This combination creates a structural role conflict in which responsibility expands faster than authority and digital access rights.

The strengthening of automated control plays a particularly significant role in the development of conflict-related burnout. Digital HR systems enable real-time monitoring of employee actions, recording deviations, and forming management decisions without direct dialogue. However, this monitoring is often not accompanied by mechanisms for feedback and review of decisions. Algorithmic "objectivity" replaces management discussion, and the ability to appeal to human judgment is limited or completely absent [2,4].

Taken together, these factors lead to conflict in the digital HR environment becoming unaddressed and difficult to recognize. Employees cannot clearly pinpoint the source of tension: formally, the system functions correctly, metrics are met, and regulations are adhered to. However, an internal sense of injustice, disproportionate demands, and loss of influence over results gradually accumulates.

One of the key effects of digitalization of management is the creation of a persistent illusion of the objectivity of decisions. Algorithms, metrics, and digital regulations are perceived as neutral instruments, free from subjective biases, personal preferences, and management errors. In organizational practice, this leads to a shift in responsibility for management decisions from specific actors to the "system," which begins to be viewed as an autonomous source of rationality [2].

This illusion significantly transforms the nature of management dialogue. Decisions based on numerical indicators are increasingly rarely the subject of discussion and reflection. The formula "that's what the system showed" becomes a definitive argument, requiring no interpretation or contextualization. As a result, management dialogue is replaced by reference to numerical data, and the ability to discuss the rationale for decisions is limited.

For employees, this means a loss of feedback space. Even with an obvious discrepancy between numerical indicators and their actual contribution to work, employees face difficulty articulating the problem. An asymmetry arises: the system makes demands and records deviations, but does not provide mechanisms for full explanation, revision, or consideration of the professional context. In this case, the conflict is not resolved, but rather "frozen" within the system [12,13].

The depersonalization of management decisions plays a key role in this process. Managers, relying on digital HR tools, increasingly act not as the subject of evaluation but as the executor of the system's logic. This reduces managerial accountability and simultaneously increases feelings of alienation among employees. Conflict loses its human dimension, making it impossible to resolve through negotiation, trust, and professional recognition.

When dialogue is lost, conflict becomes latent. It doesn't manifest itself in open confrontations, complaints, or formal disputes, but manifests itself in a decline in initiative, an increase in formal behavior, and a retreat into "safe compliance" with system requirements. Such behaviors are difficult to interpret as conflict, yet they become early indicators of conflict-related burnout [5].

In scientific and applied research, burnout is traditionally viewed as a state of emotional, cognitive, and physical exhaustion arising in response to prolonged exposure to stressful factors in the work environment. The focus typically shifts to the individual employee's experiences, personal resources, coping strategies, and level of psychological resilience. This perspective allows for describing the subjective symptoms of burnout, but is limited when analyzing the processes occurring in digitally organized work systems.

Conflict burnout in the digital age should be viewed as a form of professional maladjustment, in which the employee remains formally integrated into the organizational system but gradually loses the ability to fully function professionally. Maladjustment manifests itself not in a decline in formal effectiveness, but in a gap between external compliance with system requirements and internal acceptance of the professional role, goals, and purpose of the activity [7,8,14].

A fundamental characteristic of conflict-related burnout is its systemic nature. It arises not as a result of individual psychological characteristics of the employee, but as a response to a prolonged disconnect between digitally imposed management requirements and the actual logic of work. The

employee is forced to constantly compensate for this disconnect through cognitive and emotional effort: interpreting contradictory metrics, adapting to changing digital rules, and "translating" professional activity into the language of indicators.

It's important to emphasize that conflict-related burnout is not the same as demotivation, professional strain, or emotional exhaustion in their classical sense. It can develop despite maintaining high levels of discipline, responsibility, and even commitment to performance. Moreover, in the early and mid-stages of conflict-related burnout, employees are often perceived as "reliable" and "effective," making it difficult to promptly diagnose this condition.

Conflict burnout is a specific type of professional maladjustment that occurs in digitally mediated management environments and is characterized by a persistent disconnect between the formalized logic of the system and the employee's subjective professional experience. Approaching burnout from this perspective allows us to move beyond the individual psychological approach and move toward an analysis of the quality of an organization's management and digital architecture.

Conflict-related burnout in the digital environment has a number of specific characteristics that significantly distinguish it from classic forms of professional burnout. These characteristics are associated not so much with emotional exhaustion or decreased productivity, but rather with a transformation in the employee's attitude toward the management system, their professional role, and the logic of their own work.

The first and key sign of conflict-related burnout is a loss of trust not in management per se, but in the management system as a whole. Employees stop perceiving digital requirements, metrics, and regulations as reflecting the organization's true goals. Meanwhile, personal relationships with their immediate supervisor may remain cordial or even positive. Mistrust is directed toward the "system," which is perceived as formally correct but inherently unfair and insensitive to the professional context.

The second symptom is a sense of control without fairness. The digital environment creates the impression of high transparency and predictability of processes, but this controllability is not accompanied by a sense of proportionality between demands and rewards.

The third characteristic sign of conflict-related burnout is a discrepancy between formal effectiveness and actual engagement. Employees continue to demonstrate KPI compliance, adhere to regulations, and achieve set targets, but their involvement in work becomes increasingly instrumental.

The fourth symptom is cognitive exhaustion, which is not related to the volume of work, but to the constant need to "translate" professional activity into the language of digital metrics. Finally, an important characteristic of conflict burnout is its masking nature. Unlike classic burnout, which is accompanied by decreased productivity or emotional breakdowns, conflict burnout can remain hidden for a long time. The organization sees "working" indicators, stable processes, and formal adherence to standards, while alienation and professional maladjustment accumulate within the system.

The distinctive features of conflict burnout in the digital environment indicate its systemic nature and allow us to consider it not as an isolated case of professional distress, but as a structural effect of digital management.

One of the most complex and underestimated features of conflict burnout in the digital environment is its ability to coexist with high formal effectiveness. Unlike classic forms of burnout, which are relatively quickly reflected in decreased productivity, increased errors, or emotional instability, conflict burnout can remain undetected by the organization for a long time. [9,10].

The development of conflict-driven burnout in a digital organizational environment does not begin with a crisis or open resistance. On the contrary, in the first stage, employees demonstrate a high degree of rational adaptation to the digital demands of the system. Digital regulations, performance metrics, and control algorithms are perceived as inevitable elements of a modern organization, with which they must learn to interact effectively [4].

At this stage, emerging contradictions between the real logic of work and digital requirements are interpreted by the employee as temporary costs of the transformation. Imperfect metrics, formal procedures, and reporting overload are explained by the transitional nature of the changes. The

employee maintains trust in the system and assumes that as they are "tuned," the digital tools will become more relevant to real-world practice.

Digital adaptation is accompanied by active adoption of the system's rules. Employees learn to work with KPIs, organize their activities according to digital scenarios, interpret algorithm requirements, and minimize the risk of deviations. During this period, a stronger focus on formal correctness of actions is achieved, which often leads to improved performance indicators and positive evaluations from the organization.

It's important to note that at this first stage, conflict tension is not yet recognized as a systemic problem. Contradictions are experienced as individual difficulties requiring additional effort, flexibility, or patience. The employee strives to "adapt" to the system without questioning its fundamental logic. Moreover, professional identity remains relatively stable at this stage: the meaning of work is preserved, and digital demands are perceived as an external framework rather than a threat to professional values. The first stage of conflict burnout is characterized not by maladaptation, but, on the contrary, by successful digital adaptation. The paradox is that it is precisely this rational and loyal behavioral strategy that creates the foundation for the subsequent escalation of internal conflict.

In the second stage of conflict burnout, rational digital adaptation gives way to persistent internal tension, which can no longer be explained as a temporary cost of transformation. Employees begin to perceive the contradictions between digital demands and the real logic of work as reproducible and structural. The expectation that the system will "fine-tune" and begin to adequately reflect the content of professional activity disappears [5]. Latent conflict at this stage is primarily internal and rarely manifests openly. Formally, the employee continues to comply with regulations, meet KPIs, and demonstrate required performance. However, the way they view the system changes: digital requirements begin to be perceived not as a neutral tool, but as a source of injustice and disproportion. It feels as if the system evaluates compliance with formal scenarios rather than results. At this stage, the feeling of control without influence intensifies. The employee clearly understands the system's expected actions and the consequences of deviations from the established parameters, but sees no opportunity to truly influence the rules of the game. Feedback is either absent or limited to formal procedures that don't influence the evaluation logic. This reinforces the feeling of helplessness and diminishes the subjective significance of professional experience. The second stage of conflict burnout is characterized by the development of a persistent internal conflict between the employee's professional logic and the formalized rationality of the digital system. This conflict does not yet lead to overt alienation or decreased effectiveness, but it is at this stage that the transition to the next, deeper stage—algorithmic alienation—begins, in which internal distancing becomes the dominant strategy of professional behavior.

The third stage of conflict burnout is characterized by a transition from internal conflict to persistent employee alienation from the professional content of the organization's activities and goals. At this stage, the digital management system is no longer perceived as an environment to which one can adapt or with which it makes sense to engage in internal dialogue. It is accepted as an immutable given, with interactions reduced to fulfilling minimally sufficient requirements.

Algorithmic alienation manifests itself in a shift in motivation from professional results to the correct implementation of digital scenarios. Employees focus not on the content of the work, but on how their actions will be recorded by the system, what indicators will be reflected in reports, and how to avoid negative deviations. Professional judgment gives way to instrumental adherence to algorithms [2,9].

A characteristic feature of algorithmic alienation is a reduction in initiative without formal discipline violations. The employee stops proposing improvements, taking on additional tasks, or going beyond regulations. This behavior is rarely perceived by the organization as problematic, as it is not accompanied by overt resistance or a drop in performance. On the contrary, the system "encourages" such adaptation, as it reduces variability and managerial uncertainty.

It's important to emphasize that at this stage, conflict-related burnout takes on its most subtle form. Outwardly, the employee remains "functional," manageable, and predictable. However, it is

precisely this algorithmic alienation that creates the foundation for long-term organizational losses: the degradation of professional expertise, the loss of innovative potential, and the development of a culture of simulating performance. The third stage of conflict-related burnout reflects the transition from internal resistance to institutionally entrenched alienation.

The fourth stage of conflict burnout is characterized by the transition of the individual state into a stable organizational pattern. At this stage, a collective norm of formal compliance with digital requirements is formed while minimizing substantive involvement. Behavior focused on meeting metrics without going beyond the algorithms is perceived as rational and professionally correct. Initiative, critical reflection on processes, and attempts to revise digital logic, on the contrary, begin to be viewed as sources of risk and managerial instability [15].

Management selection plays a special role in normalizing conflict-related burnout. Digital evaluation and promotion systems reward employees who are most effectively adapted to algorithmic requirements. As a result, those who exhibit formally correct but aloof behavior become role models for new employees. Conflict-related burnout is reproduced not through pressure, but through training and socialization in the digital environment. The fourth stage of conflict burnout is not a crisis, but a state of managerial equilibrium achieved at the cost of alienating human capital. The organization continues to function and demonstrate digital effectiveness, but it loses its internal sources of development. In this sense, normalizing conflict burnout is the most dangerous stage, as it makes burnout invisible, socially acceptable, and managerially reproducible.

Conflict burnout in the digital environment is not only an individual state of professional maladjustment but also a significant source of management and HR risks. One of the key risks of conflict burnout is the systemic distortion of HR analytics data. Digital HR platforms record KPI performance, compliance with regulations, discipline, and formal engagement, but do not reflect the degree of professional alienation, loss of meaning, and internal conflict among employees. As a result, management decisions are made based on an incomplete and formally favorable picture [3].

Conflict burnout contributes to the phenomenon of pseudo-efficiency, in which achieving numerical indicators replaces real improvements in processes and results. Employees optimize their behavior to meet system requirements, minimizing any actions that do not directly impact measurable parameters [10].

Another significant risk is the gradual loss of workers' professional agency. Algorithmic alienation and the normalization of conflict-driven burnout foster a mindset of minimal compliance with system requirements, in which personal responsibility for results is replaced by responsibility for compliance with procedures [9].

Conflict burnout doesn't always lead to immediate employee dismissal, but it does create the phenomenon of so-called "silent" turnover. Employees remain with the organization but effectively exit the zone of professional development, limiting their contributions to formal responsibilities [12]. Finally, conflict burnout reduces an organization's capacity for managerial reflection. The illusion of digital objectivity and stable indicators creates a sense of control and predictability that replaces the analysis of real processes. Management increasingly focuses on adjusting metrics rather than rethinking the logic of labor management [12]. As a result, the organization loses sensitivity to weak crisis signals, and management errors are discovered already at the stage of systemic failures, when recovery requires significantly greater resources (Table 1).

Table 1 - Management and HR risks of conflict burnout in a digital organization

Risk group	Source of risk in digital governance architecture	The mechanism of formation of conflict burnout	How risk is masked in numbers	Long-term management implications

Distortion of HR analytics	KPI-oriented HR platforms that capture only measurable parameters	Adapting employees to the logic of metrics when professional meaning is lost	Stable KPIs, positive performance dynamics, low level of formal conflicts	Making erroneous management decisions; strengthening the conflict logic of management
Formation of pseudo-efficiency	Priority of reporting over work content	Shifting behavior toward optimizing metrics rather than improving processes	Growth of production and management metrics without qualitative changes	Degradation of processes; institutionalization of imitation activities
Loss of initiative and subjectivity	Algorithmic management without management dialogue	Algorithmic alienation and the decline of professional judgment	"Executive discipline", absence of complaints and resistance	Loss of innovative potential; decreased organizational adaptability
"Silent" staff turnover	Lack of mechanisms for detecting latent burnout	Internal employee departure without formal dismissal	Stable staffing levels; low turnover	Loss of key expertise; increased dependence on formal regulations
Degradation of managerial reflection	The illusion of digital objectivity and controllability	Replacing process analysis with metrics analysis	High controllability "according to reports"	Delayed response to crises; rising costs of management errors
Cultural normalization of alienation	Digital selection of "convenient" employees	Reproduction of formally loyal but alienated behavior patterns	Absence of open conflicts; "quiet agreement"	Erosion of organizational culture; loss of long-term sustainability
Declining quality of management decisions	Decisions made without contextual interpretation of data	The gap between digital data and actual work practices	High speed of decision making	Misguided strategic decisions; accumulation of hidden risks

Analyzing conflict-related burnout in a digital organization requires abandoning a purely individual psychological approach and moving to a systemic level of diagnostics. Traditional burnout assessment tools focus on employees' subjective experiences and poorly capture the structural sources of stress associated with digital HR systems, algorithmic management, and metrics. In the context of digitalization, this leads to a methodological gap between observed symptoms and their actual causes.

In response to this gap The Digital Conflict Burnout Index (DCBI) conceptual model is proposed—an analytical index designed to identify and assess conflict burnout as a systemic effect

of digital management. The DCBI is not a psychometric test and is not intended to measure the individual resilience of employees. Its object is the conflictual logic of the digital management architecture, within which professional maladjustment is formed. Methodologically, DCBI is based on the concept of burnout as an indicator of a misalignment between three levels: digital management requirements; real labor logic; subjective professional experience of employees. The index does not measure the intensity of emotions, but the degree of stability of this discrepancy.

The DCBI model comprises four interrelated dimensions, each reflecting a key source of conflict burnout in the digital environment. Together, these dimensions allow for the creation of a comprehensive profile of conflict stress at the department, role, and process levels.

Conflict of Metrics (CM) is a conflict of digital metrics. This dimension reflects the degree of discrepancy between performance indicators (KPIs, OKRs, SLAs) and actual professional contribution. High CM values are typical for situations in which metric achievement does not correlate with performance quality, and metrics encourage formal or imitative behavior [2,5].

Conflict of Roles (CR) is a role conflict in the digital environment. CR captures the discrepancy between formally defined digital roles and actual expectations of employees. In digital organizations, role conflict is exacerbated by the expansion of responsibilities without adequate redistribution of authority and digital access rights [13].

Conflict of Control (CC) is a conflict between control and autonomy. This dimension reflects the tension that arises when automated control is strengthened without a commensurate expansion of professional autonomy. High CC values are characteristic of systems where algorithmic monitoring replaces managerial dialogue, and decisions are made without the possibility of appeal [2,4].

Conflict of Meaning (CMg) is a conflict of professional meaning. CMg reflects the degree of loss of subjective meaning in activities under digital management. A conflict of meaning arises when digital goals and metrics cease to correlate with professional values and the significance of work results [9,10].

In a generalized form, the conflict burnout index can be represented by the following conceptual relationship:

DCBI = f (CM + CR + CC + CMg). Each dimension is assessed using a conflict misalignment intensity scale. However, the model does not assume a rigid, universal scoring scale. Specific assessment and scaling methods should be adapted to the industry context, level of digital maturity, and nature of professional activity. DCBI focuses primarily on: comparative analysis of departments and processes; identification of areas of systemic management risk; assessment of the side effects of digital transformations.

At the conceptual level, three zones of index interpretation can be distinguished. A low DCBI level indicates alignment of digital management systems with the logic of work. Conflicts are localized and do not lead to sustained professional maladjustment. The average DCBI level reflects latent conflict burnout. Formal effectiveness is maintained, but there is a decline in engagement, an increase in cynicism, and a focus on minimal compliance with system requirements. A high level of DCBI indicates institutionalized conflict burnout. The digital management architecture becomes a source of chronic maladaptation, leading to pseudo-efficiency, a loss of initiative, and a degradation of management decisions.

The use of DCBI allows us to shift the focus of HR analytics and management analysis from assessing individual well-being to the quality of digital management; from the symptoms of burnout to their structural causes; from reactive measures to preventive diagnostics. The model is particularly relevant for highly digitalized organizations, where traditional engagement and satisfaction surveys do not reflect the actual level of conflict tension and professional maladjustment.

It should be noted that the proposed model is conceptual in nature and requires further empirical validation. Promising research areas include developing industry-specific scales for measuring DCBI

components, integrating the index into HR analytics systems, and analyzing its relationship with turnover, innovation, and organizational resilience indicators.

The Digital Conflict Burnout Index (DCBI) model allows us to view conflict burnout not as an individual employee problem, but as an indicator of the quality of digital management architecture. Using the DCBI creates a methodological basis for moving from symptomatic "burnout treatment" to the deliberate design of resilient digital organizations (Table 2).

Table 2 - Diagnostic model of Digital Conflict Burnout Index (DCBI) for HR audit in a digital organization

DCBI Measurement	Systemic source of conflict	Manifestations in the digital environment	Behavioral markers of employees	Organizational indicators (HR data)	Diagnostic questions of HR audit	Management risks
CM – Conflict of Metrics	Misalignment between digital metrics and the actual logic of work	KPIs do not reflect actual contribution; indicators contradict each other; metrics encourage imitation	Formal "closure" of indicators; avoidance of initiatives; focus on the report rather than the result	Increased formal efficiency while engagement declines; discrepancies between KPIs and business results	Does achieving KPIs actually lead to process improvement? Are there situations where high-quality work degrades performance?	Pseudo-efficiency; degradation of professional standards; distortion of HR analytics
CR – Conflict of Roles	Role ambiguity enhanced by digital contours	Multiple digital roles; responsibility without access rights; conflicting expectations between systems	Emotional fatigue; defensive behavior; refusal to make decisions	Increased errors in formal compliance with regulations; increased approvals and escalations	Do formal digital roles align with real-world tasks? Are there areas of "responsibility without influence"?	Chronic stress; managerial overload; loss of agency

CC – Conflict of Control	The imbalance between digital control and autonomy	Algorithmic monitoring; no appeals; control without dialogue	Passive loyalty; decreased initiative; retreat to "minimally acceptable" behavior	Declining proposals for improvements; increasing hidden resistance; "silent sabotage"	Is the level of control commensurate with the level of responsibility? Can the employee influence digital decisions?	Loss of innovative potential; increased alienation; decreased trust
CMg – Conflict of Meaning	The gap between digital goals and professional meanings	Reducing work to script execution; substituting metrics for meaning	Cynicism; emotional detachment; loss of identification with the profession	A steady decline in engagement without overt conflict; an increase in "burned-out but productive" employees	Do employees understand the purpose of digital requirements? Do they see the value of the results?	Cultural erosion; loss of loyalty; long-term degradation of human capital

This study allows us to examine conflict-related burnout in the digital age as a systemic organizational phenomenon that goes beyond individual psychological interpretations of professional exhaustion. In the context of algorithmic management, KPI-oriented HR systems, and digital platforms, burnout develops not so much as a reaction to overload or emotional stress, but rather as a consequence of persistent contradictions between formalized management logic and actual work practices [2,5].

The article demonstrates that digitalization is transforming the very nature of organizational conflict. Conflict loses its interpersonal nature and shifts to the level of systems, metrics, and algorithms, deprived of an addressee and the space for managerial dialogue. This results in conflict burnout—a form of professional maladjustment in which external effectiveness and compliance with digital requirements coexist with internal alienation, loss of professional meaning, and a decline in employee agency.

An analysis of the stages of conflict-related burnout suggests that this condition is not a sudden crisis. It develops as a consistent and rational process of adaptation to the conflict-driven logic of digital management—from initial digital adaptation through latent conflict and algorithmic alienation to the institutionalization of burnout at the organizational cultural level. It is precisely this gradual nature and rationality that makes conflict-related burnout difficult to diagnose and managerially dangerous.

The study focuses on the managerial and HR risks of conflict-related burnout. It is shown that its normalization leads to distorted HR analytics, the development of pseudo-efficiency, a loss of initiative, and a decline in managerial self-reflection. An organization can demonstrate stable performance indicators while simultaneously losing human capital as a source of development and adaptation.

The methodological outcome of the study is a conceptual model, the Digital Conflict Burnout Index (DCBI), aimed at diagnosing conflict-related burnout as a systemic effect of digital management. Unlike traditional burnout assessment tools, the DCBI allows for the analysis of the

quality of digital management architecture and the identification of areas of conflictual misalignment between metrics, roles, control, and professional purpose [3,6,7].

The practical significance of the obtained results lies in the opportunity to rethink approaches to personnel management in a digital environment. Conflict burnout in this context is viewed not as an individual employee problem, but as a signal for the need to reconsider the logic of digital HR systems and management decisions. This creates the basis for a transition from reactive personnel support measures to preventive and reflexive management of digital transformations.

Conflict burnout is an important indicator of the limits and side effects of digitalization of management. Understanding and assessing it allows organizations to move beyond the illusion of digital efficiency and build more sustainable human capital management models capable of combining technological rationality with the professional meaning and agency of work.

LITERATURE

1. Zuboff, S. (1988). In the age of the smart machine: The future of work and power. Basic Books.
2. Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. PublicAffairs.
3. Davenport, T. H., Harris, J. G., & Shapiro, J. (2010). Competing on talent analytics. Harvard Business Review, 88(10), 52–58.
4. Rosenblat, A. (2018). Uberland: How algorithms are rewriting the rules of work. University of California Press. https://doi.org/10.1525/9780520970632.
5. Kellogg, K. C., Valentine, M. A., & Christin, A. (2020). Algorithms at work: The new contested terrain of control. Academy of Management Annals, 14(1), 366–410. https://doi.org/10.5465/annals.2018.0174.
6. Maslach, C., & Leiter, M. P. (2016). Burnout: The cost of caring. Malor Books.
7. Maslach, C., Schaufeli, W. B., & Leiter, M. P. (2001). Job burnout. Annual Review of Psychology, 52, 397–422. https://doi.org/10.1146/annurev.psych.52.1.397.
8. Schaufeli, W. B., & Taris, T. W. (2014). A critical review of the Job Demands–Resources Model: Implications for improving work and health.
9. Sennett, R. (1998). The corrosion of character: The personal consequences of work in the new capitalism. W. W. Norton & Company.
10. Graeber, D. (2018). Bullshit jobs: A theory. Simon & Schuster.
11. March, J. G., & Simon, H. A. (1958). Organizations. Wiley.
12. Clegg, S. R., Courpasson, D., & Phillips, N. (2006). Power and organizations. Sage Publications.
13. Bélanger, J., & Edwards, P. (2013). The nature of front-line control: Supervisors, managers and work organizations in a changing context. Work, Employment and Society, 27(2), 161–177. https://doi.org/10.1177/0950017012471283.
14. Bakker, A. B., & Demerouti, E. (2007). The Job Demands–Resources model: State of the art. Journal of Managerial Psychology, 22(3), 309–328. https://doi.org/10.1108/02683940710733115.
15. Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. American Journal of Sociology, 83(2), 340–363. https://doi.org/10.1086/226550.

https://doi.org/10.5281/zenodo.18810581
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VISUALIZATION OF THE EXPERIMENTAL STUDY OF HEMISPHERICAL FOUNDATIONS WITH PROTRUDING CANTILEVERS ON A SUBSIDING BASE IN COAL DEPOSITS USING VOSVIEWER

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Abstract. *A bibliometric analysis was conducted to map the scientific landscape of research on hemispherical foundations with protruding cantilevers on subsiding bases in coal mining regions. Based on Web of Science data for the period 2020–2025, 66,651 publications were analyzed using VOSviewer software (version 1.6.15). Co-occurrence networks of keywords (Author Keywords and Keywords Plus) were constructed, followed by clustering with a threshold of ≥4 occurrences and an additional constraint of ≥100 links per cluster.*

A total of 300 most frequent terms were identified, dominated by: model, permeability, mine, numerical modeling, deformation, methane, ground subsidence, coal mining, stress, behavior, stability. Comparison of author-assigned keywords and Keywords Plus revealed differences in focus: authors tend to use more specific terms (hydraulic fracturing, water injection into coal seam, InSAR), while Keywords Plus reflect broader aspects (fractal dimension, permeability enhancement, stress evolution).

The analysis highlights the interdisciplinary nature of the topic at the intersection of geotechnical engineering, mining, and computational mechanics, emphasizing the critical role of numerical modeling, hydro-mechanical interactions, and deformation monitoring (including InSAR) for predicting foundation behavior under mining-induced subsidence. Promising research directions include optimization of cantilever geometry, long-term stability assessment, and integration of machine learning methods.

The findings can serve as a methodological foundation for systematic reviews and the development of more reliable foundation design approaches in coal-mining regions, helping to reduce risks associated with ground subsidence.

Key words: *hemispherical foundations, protruding cantilevers, ground subsidence, coal deposits, numerical modeling, foundation deformation*

The study of hemispherical foundations with protruding cantilevers on a subsiding base is a critical research area in geotechnical engineering, particularly in regions affected by coal deposits. This part aims to visualize and analyze the scientific landscape of experimental studies related to foundation behavior under subsidence conditions using bibliometric mapping. A systematic review of relevant publications was conducted, and VOSviewer was applied to identify key keywords, thematic clusters, and research trends, providing an integrated overview of the development and focus areas within this field [1].

We exported metadata from 66,651 publications from the Web of Science (WoS) database using the following query: "TITLE: ("hemispherical foundations" OR "hemisphere foundation" OR "hemispherical footing" OR "cantilever foundations" OR "protruding cantilevers" OR "cantilevered foundations" OR "subsiding base" OR "subsidence foundation" OR "ground subsidence" OR "coal deposits" OR "coal seam" OR "coal mining areas" OR "experimental study" OR "experimental

investigation" OR "physical modeling" OR "foundation behavior" OR "foundation performance"), timespan: 2020–2025. Indexes: SCI - EXPANDED, SSCI, CPCI - S, ESCI. The construction of a network of co-occurrence of keywords and their clustering was carried out using the VOSviewer 1.6.15 program [2].

The minimum occurrence of keywords selected for consideration was four. The total number of keywords in the 66,651 publications considered (Authors and Keywords Plus generated by WoS) is 4,237. The number of keywords that appear at least 4 times is 300, and further analysis was carried out on them.

During the analysis, the spellings of keywords were not translated into Russian in order to preserve their original meanings. To reduce the number of clusters into which keywords (KW) are aggregated, an additional restriction has been introduced: at least 100 KW per cluster.

Table 1 presents a comprehensive visualization of the experimental study of hemispherical foundations with protruding cantilevers constructed on a subsiding base in coal deposit areas. The visualization, developed using VOSviewer, illustrates the relationships between key research parameters, including foundation geometry, cantilever protrusion length, load transfer mechanisms, stress–strain behavior, ground subsidence effects, and stability performance. This analysis highlights dominant research themes, keyword co-occurrence, and interconnections among experimental variables, supporting the evaluation and optimization of foundation design under mining-induced subsidence conditions.

Table 1- 40 most frequently occurring keywords in a sample of 66,651 metadata

Keyword	**N-kw**	**Keyword**	**N-kw**	**Keyword**	**N-kw**	**Keyword**	**N - kw**
model	105	stress	42	water	29	extraction	24
permeability	80	flow	41	prediction	29	strata	23
mine	66	ground subsidence	40	adsorption	27	gas extraction	22
numerical simulation	65	impact	38	pressure	26	diffusion	21
deformation	56	behavior	36	basin	26	coalbed methane	21
methane	55	coal seam	36	land subsidence	25	desorption	19
simulation	54	failure	34	technology	25	fracture	19
mechanism	51	coal mining	32	numerical-simulation	24	drainage	17

evolution	46	coal	32	coal seam gas	24	methane recovery	16
rock	44	stability	30	gas	24	carbon-dioxide	15

Notes: keyword is the name of the term; N-kw is the occurrence of the term.

The dominant keywords are related to the topic, its model, permeability, mine, numerical simulation, deformation, methane, simulation, mechanism, evolution, rock, stress, flow, ground subsidence, impact, behavior, coal seam, failure, coal mining, coal, stability, water, prediction, adsorption, pressure, and basin.

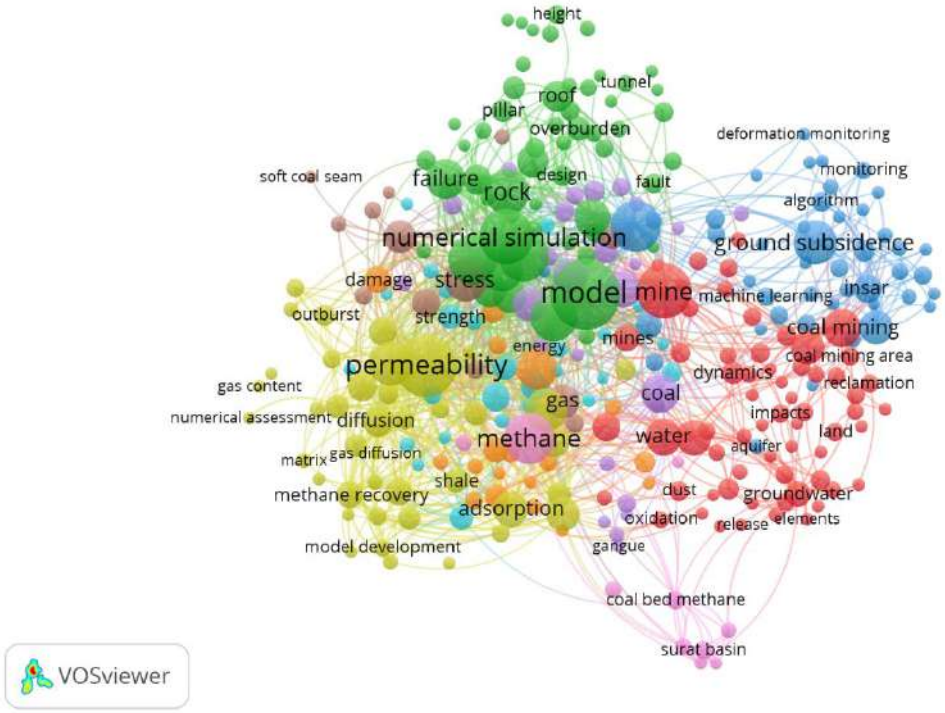

Figure 1- Keyword Co-Occurrence Network Visualization: 300 Most Frequent Terms in 66,651 Publications

If we consider separately the keywords of the authors themselves, then with a total number of 29,98 KW, 93 KW occur at least four times, while the total number of keywords plus (Keywords Plus) generated by the WoS platform is 1,495 and those encountered more than four times are 188.

Table 2 - Comparison of the 30 most common keywords used by publication authors and WoS platform keywords

Author Keywords	N-kw	Keywords Plus	N-kw
numerical simulation	65	fractal dimension	9
ground subsidence	39	permeability enhancement	9

coal seam	36	extra-thick coal seam	9
coal mining	32	subsidence	9
coal	30	numerical modeling	8
coal seam gas	24	groundwater	8
permeability	23	methane	
coalbed methane	21	stress evolution	7
gas extraction	21	coal bed methane	7
hydraulic fracturing	18	monitoring	6
gas drainage	14	deformation	5
coal seam water injection	14	hydraulic flushing	5
stress distribution	13	numerical model	5
thick coal seam	10	deformation monitoring	4
insar	10	deep learning	4

The table 2 presents the result of a comparison of the 30 most common keywords of publication authors and keywords of the WoS platform. It shows that authors often use more general terms to classify their publications: numerical simulation, ground subsidence, coal seam, coal mining, coal, coal seam gas, permeability, coalbed methane, gas extraction, hydraulic fracturing, gas drainage, coal seam water injection, stress distribution, thick coal seam, and insar.

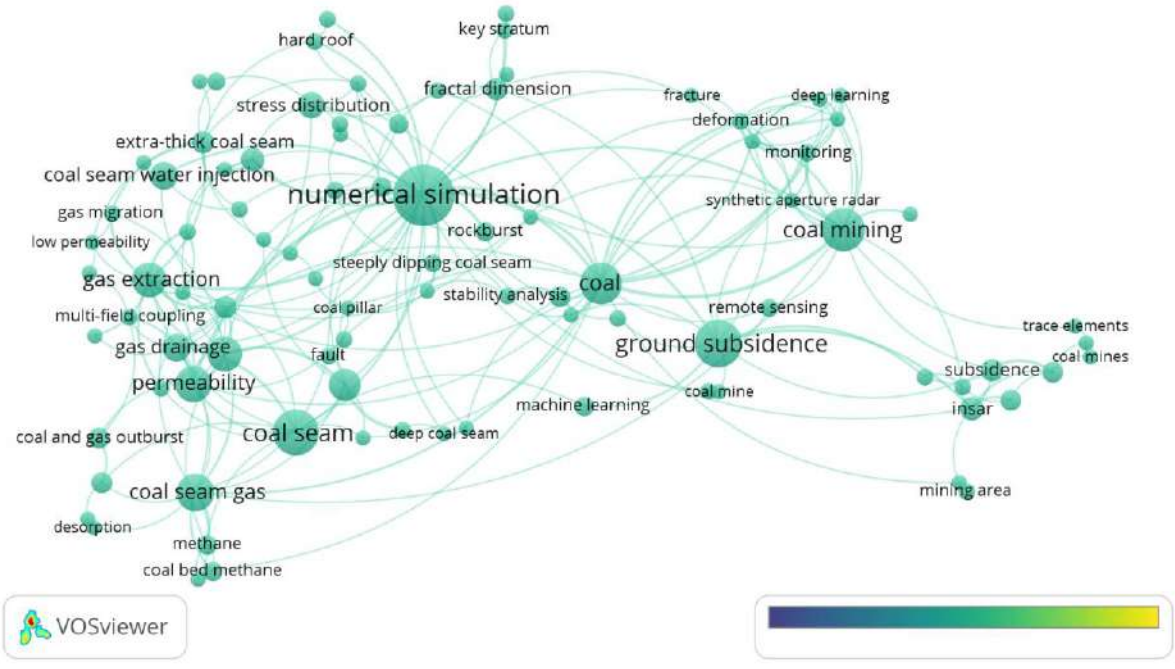

Figure 2- Overlay Visualization of 30 Most Common Keywords: Author-Assigned vs. WoS-Generated Terms

The Web of Science (WoS) platform also generates a list of "Keywords Plus" based on the analysis of the full texts of publications. These terms often describe the topic from a broader perspective than the authors' original keywords. In this case, the dominant terms include: model, permeability, methane, deformation, evolution, mine, simulation, flow, stress, impact, mechanism, behavior, adsorption, pressure, rock, failure, diffusion, methane recovery, numerical-simulation, and water which collectively provide a deeper insight into the implementation of the themes addressed by the authors' keywords [3].

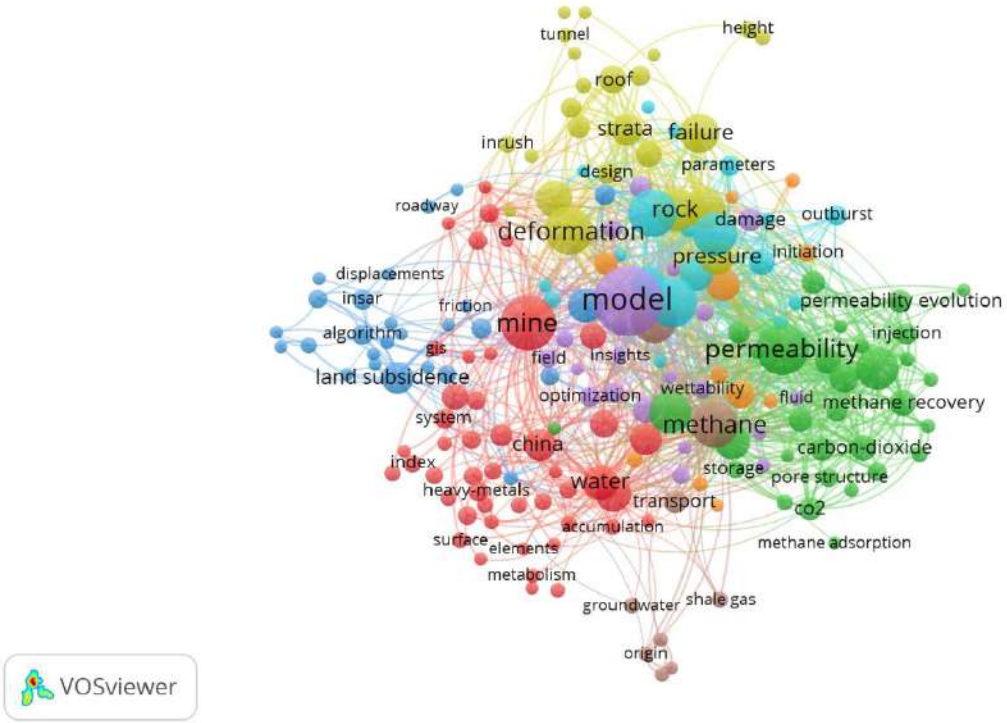

Figure 3- Keywords Plus Co-Occurrence Network Visualization: 188 Most Frequent in 66,651 Publications

This is also reflected in the clustering of author keywords, WoS platform keywords and the sum of these keywords. Clustering is based on the co-occurrence of keywords in a publication; the clustering algorithm is described in detail in the VOSviewer 1.6.15 user manual. Identification of the dominant keywords in each cluster allows us to reduce bias in the further collection of scientific publications on a narrower issue, for example, to compile a systematic review. A well-known problem of narrow specialists: they see their topic well, overestimate the importance of key terms close to them and tend to underestimate other people's topics. At the same time, a significant part of innovations is implemented at the intersection of research areas.

This analysis provides a comprehensive and systematic review of the current state of research on hemispherical foundations with protruding cantilevers constructed on subsiding bases in coal deposit regions, using advanced bibliometric and visualization techniques. By applying VOSviewer to a large dataset extracted from the Web of Science database, the scientific landscape of experimental

and numerical studies in this field was mapped, allowing the identification of dominant keywords, thematic clusters, and emerging research trends. The visualization results reveal that core research themes are strongly centered on ground subsidence, stress–strain behavior, numerical simulation, permeability evolution, and stability performance of foundations under mining-induced deformation conditions [4].

The findings highlight a clear interdisciplinary convergence between geotechnical engineering, mining engineering, and computational mechanics. Experimental modeling and numerical simulations play a critical role in understanding load transfer mechanisms, deformation evolution, and failure modes of hemispherical and cantilevered foundation systems in subsiding environments. The strong presence of keywords related to coal mining, methane, permeability, and rock behavior further demonstrates the close relationship between foundation performance and subsurface processes occurring in coal seams and surrounding strata [5]. These results confirm that foundation design in mining areas cannot be addressed independently of hydro-mechanical and geomechanical interactions within the ground mass [6].

Moreover, the bibliometric clustering indicates a growing emphasis on advanced numerical methods, including finite element modeling, coupled hydro-mechanical simulations, and data-driven approaches for predicting subsidence effects and foundation response. The integration of monitoring technologies such as InSAR and deformation tracking is increasingly reflected in recent publications, supporting more accurate validation of experimental and numerical results [7]. This trend suggests a shift toward more reliable, predictive, and performance-based foundation design methodologies in subsidence-prone regions.

The results of this study can serve as a methodological foundation for developing future research programs and systematic reviews focused on specific aspects of foundation behavior under mining-induced subsidence, such as cantilever length optimization, stress redistribution mechanisms, and long-term stability assessment [8]. In addition, the identified research gaps highlight opportunities for innovation through interdisciplinary collaboration, particularly by combining geotechnical experimentation, numerical modeling, and machine learning techniques for improved prediction of complex ground–structure interactions [9].

In total, this study contributes to a deeper understanding of the complex relationships between foundation geometry, subsiding ground conditions, and mechanical response mechanisms. The insights obtained from the VOSviewer-based visualization can support the development of safer and more efficient foundation design strategies for infrastructure in coal mining regions, ultimately reducing structural risks and improving resilience against ground subsidence hazards [10].

REFERENCES

1. N. J. van Eck and L. Waltman, “Software survey: VOSviewer, a computer program for bibliometric mapping,” Scientometrics, vol. 84, no. 2, pp. 523–538, 2010.
2. VOSviewer Manual: Van Eck, N. J., & Waltman, L. (2021). VOSviewer Manual: Version 1.6.15. Centre for Science and Technology Studies, Leiden University.
3. Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. Journal of the American Society for Information Science and Technology, 57(3), 359–377.
4. Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007.
5. Whittaker, B. N., & Reddish, D. J. (1989). Subsidence: Occurrence, prediction and control. Amsterdam: Elsevier Science Publishers.
6. Kratzsch, H. (1983). Mining subsidence engineering. Berlin: Springer-Verlag. https://doi.org/10.1007/978-3-642-82173-8.
7. Galloway, D. L., Jones, D. R., & Ingebritsen, S. E. (1999). Land subsidence in the United States. U.S. Geological Survey Circular 1182.
8. Das, B. M., & Sobhan, K. (2018). Principles of geotechnical engineering (9th ed.). Boston: Cengage Learning.
9. Zhan, H., Deng, J., Li, X., & Zhang, Y. (2020). Numerical simulation of ground subsidence induced by underground coal mining. International Journal of Rock Mechanics and Mining Sciences, 132, 104365. https://doi.org/10.1016/j.ijrmms.2020.104365.
10. Xu, N., Kulatilake, P. H. S. W., Tian, H., & Wu, X. (2016). Stability analysis of foundations under mining-induced subsidence using numerical modeling. Engineering Geology, 210, 1–12. https://doi.org/10.1016/j.enggeo.2016.05.014.

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ОБЗОР ЭКСПЕРИМЕНТАЛЬНЫХ ИССЛЕДОВАНИЙ ПОЛУСФЕРИЧЕСКИХ ФУНДАМЕНТОВ С ВЫСТУПАЮЩИМИ КОНСОЛЯМИ НА ПОДРАБАТЫВАЕМЫХ ОСНОВАНИЯХ В УГОЛЬНЫХ МЕСТОРОЖДЕНИЯХ

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Аннотация. *В статье представлен обзор экспериментальных исследований фундаментов, предназначенных для эксплуатации на подрабатываемых основаниях угольных месторождений, с акцентом на конструкции полусферического и конического типа с выступающими консолями. Рассматриваются результаты полевых и лабораторных испытаний, выполненных в условиях горной подработки, сопровождающейся горизонтальными и вертикальными деформациями грунтового массива. Проанализированы особенности работы фундаментов при различных стадиях деформирования основания, включая упругую и пластическую фазы, а также их устойчивость к неравномерным осадкам и кренам. Показано, что применение фундаментов с криволинейной формой подошвы и выступающими консолями позволяет повысить несущую способность и снизить дополнительную осадку по сравнению с традиционными столбчатыми и плитными фундаментами. Сделан вывод о перспективности использования полусферических и близких к ним конструкций в зонах интенсивной подработки, а также обозначены направления дальнейших исследований, связанных с численным моделированием и долгосрочным мониторингом деформаций.*

Ключевые слова: *подрабатываемые основания; угольные месторождения; горная подработка; полусферические фундаменты; конические фундаменты; выступающие консоли; несущая способность; осадка фундамента; деформации грунта; устойчивость сооружений.*

Экспериментальные исследования в этой области фокусируются на разработке и тестировании специальных конструкций фундаментов, предназначенных для работы в условиях горной подработки, вызванной добычей угля. Такие фундаменты должны компенсировать горизонтальные и вертикальные деформации грунта, чтобы обеспечить стабильность зданий и сооружений. Основной акцент делается на регионах с интенсивной угледобычей, таких как Карагандинский угольный бассейн в Казахстане, где подработка приводит к значительным сдвигам почвы. Хотя прямые упоминания полусферических фундаментов редки, близкие конструкции — конические фундаменты с выступающими элементами — активно тестируются как альтернатива, обеспечивающая повышенную несущую способность. Ниже приведен обзор ключевых аспектов на основе доступных научных данных.

Основные цели и методология исследований. Цели: Оценка несущей способности фундаментов под влиянием подработки, моделирование деформаций грунта от угледобычи, сравнение с традиционными конструкциями (например, прямоугольными или плитными фундаментами). Исследования направлены на минимизацию рисков разрушения зданий в

зонах subsidence, где горизонтальные деформации могут достигать 2–3 мм/м, а вертикальные осадки — до 10–20 см.

Методы экспериментов: Полевые испытания: Проводятся на реальных объектах в угольных бассейнах. Например, в Карагандинском бассейне (шахта им. И.А. Костенко) фундаменты закладываются на глубину 0,5–0,75 м. Используются штампы для имитации нагрузки от колонн или пирсов, с площадью контакта 2400–4400 см².

Нагрузочные тесты: Вертикальные нагрузки применяются ступенчато (до 12,5 кН), с измерением осадок с помощью индикаторов часового типа. Горизонтальные деформации моделируются сеткой маркеров (3×3 м на глубине 1,5 м), имитирующими подработку от добычи угля.

Параметры конструкций: Тестируются фундаменты с углом введения 70–90°, диаметром основания 0,42–0,75 м, с выступающими консолями для увеличения опорной площади. Также изучаются комбинированные сваи-стойки высотой 270–540 мм.

Учет подработки: Деформации грунта от угледобычи (горизонтальные растяжения до $2{,}6\times10^{3}$) фиксируются в реальном времени, с анализом эластичной и пластической стадий деформации.

Ключевые результаты экспериментов. Несущая способность: В эластичной фазе осадка фундаментов с выступающими консолями аналогична традиционным (пирсовым), но при подработке конические конструкции показывают преимущество — опорная площадь увеличивается пропорционально заглублению, повышая устойчивость на 15–20%. Например, эмпирическая формула осадки: $S_a = S_0(1 + D\cdot s)$, где S_0 — осадка без деформации, s — горизонтальное растяжение (0–1240), D = 17,7–115,5 в зависимости от конструкции (выше для комбинированных свай с консолями).

Сравнение с другими типами: Конические фундаменты с консолями превосходят прямоугольные на 10–30% по несущей способности в условиях subsidence. Традиционные фундаменты сохраняют постоянную площадь контакта, в то время как конические адаптируются к деформациям. Нет прямого сравнения с чисто полусферическими, но конические рассматриваются как аналогичные shell-структурам (оболочкам), где кривизна помогает распределить нагрузку. Нами представлен вариант сравнения конических фундаментов с выступающими консолями (как ближайший прототип полусферических/оболочечных) с традиционными типами фундаментов в условиях подработки (subsidence от угледобычи Карагандинский бассейн). Данные основаны на полевых и лабораторных испытаниях (в основном работы Базарова Б.А., Конакбаевой А.Н. и соавторов), где прямое сравнение проводилось с столбчатыми/прямоугольными фундаментами (штампами, имитирующими их) (таблица1).

Таблица 1 – Сравнение конических фундаментов с выступающими консолями с традиционнными типами фундаментов

Параметр сравнения	Конические с консолями / выступающей "пятой"	Прямоугольные / столбчатые (традиционные)	Преимущество конических в условиях подработки	Примечание / источник
Несущая способность в упругой стадии (до подработки)	Эквивалентна традиционным (стартовые площадки нагружения равны)	Базовая (зависит от площади подошвы)	Нет преимущества (равны)	Полевые испытания Караганда
Несущая способность после	Значительно выше (увеличивается	Снижается или остаётся постоянной	+10–30% и более (в зависимости от	Базаров и др., натурные тесты

подработки (при горизонтальных деформациях растяжения)	за счёт адаптации формы и консолей)		угла врезания и консолей)	
Осадка при подработке (рост осадки от деформаций грунта)	Рост осадки меньше (консоли распределяют нагрузку, компенсируют сдвиги)	Рост осадки выше (постоянная площадь контакта)	Снижение дополнительной осадки на 1–16% (в зависимости от близости к шахте)	Эксперименты показывают меньший прирост осадки
Адаптация к деформациям (горизонтальное растяжение, крен)	Высокая (кривизна + консоли увеличивают опорную площадь при просадке)	Низкая (постоянная площадь, риск концентрации напряжений)	Существенно лучше (адаптивность оболочечной формы)	Аналог shell-структур
Риск крена и перекоса	Низкий-средний (консоли распределяют нагрузку на большую площадь)	Высокий (неравномерная осадка приводит к крену)	Снижение риска крена	Выступающие консоли — ключевой фактор
Риск разрушения конструкции при сильной подработке	Средний (зависит от армирования и угла)	Высокий (трещины, потеря устойчивости)	Ниже за счёт лучшего распределения	Нет прямых данных по полусферическим
Стоимость и сложность изготовления	Выше (сложная опалубка, больше бетона)	Ниже (простая форма)	Минус (экономия на ремонте в будущем)	Не количественно в тестах

Влияние подработки: В угольных месторождениях (как в Караганде) деформации от добычи приводят к росту осадки на 1–16% в зависимости от близости к шахте. Эксперименты показывают, что выступающие консоли снижают риск крена, распределяя нагрузку на большую площадь.

Основные риски связаны с деформациями грунта от добычи угля (вертикальные просадки, горизонтальные растяжения/сжатия, неравномерные осадки). Степень риска оценивается по нормам СП 21.13330.2012 (Здания и сооружения на подрабатываемых территориях) — категории подработки от I до V (от слабой до очень сильной) (таблица 2).

Таблица2 - Основные риски

Риск	Описание	Степень риска для традиционных (прямоугольных/столбчатых) фундаментов	Степень риска для коническ их с	Комментарий

			консолями	
Неравномерная осадка и крен	Поворот здания из-за разницы осадок по углам/сторонам	Высокий (особенно при близости к шахте)	Низкий–средний	Консоли снижают крен за счёт перераспределения нагрузки
Дополнительная осадка от подработки	Рост осадки на 1–16% (иногда больше) при горизонтальных деформациях	Высокий (до 16% и более при сильной подработке)	Средний (рост меньше благодаря адаптации)	Из полевых данных Караганды
Трещинообразование в грунте и фундаменте	Растяжение → трещины в основании, потеря несущей способности	Высокий	Средний	Кривизна помогает рассеивать напряжения
Потеря устойчивости (сдвиг, опрокидывание)	Горизонтальные сдвиги грунта	Высокий (при растяжении >2–3 мм/м)	Низкий–средний	Консоли увеличивают сопротивление сдвигу
Долгосрочная деградация (10–20+ лет)	Постепенное накопление деформаций от повторных подработок	Высокий	Средний	Лучшая адаптивность оболочечных форм

Вывод по рискам**:** Конические фундаменты с консолями существенно снижают риски крена, дополнительной осадки и потери устойчивости по сравнению с традиционными (на 10–30% по несущей способности и заметно по деформациям). Полусферические (как чистые shell-структуры) теоретически могут быть ещё эффективнее за счёт равномерного распределения нагрузок, но прямых экспериментов по ним в Караганде нет — они считаются аналогичными коническим.

Проблемы и рекомендации: Основные вызовы — неравномерная осадка и трещинообразование в грунте. Рекомендуется комбинировать с геосинтетикой для армирования основания. Исследования соответствуют нормам СП 50-102-2003 и СП 24.13330.2011, требующим учета изменений свойств грунта под влиянием mining subsidence.

Общие тенденции в направлении. Региональный фокус: Большинство экспериментов проводятся в угольных бассейнах СНГ (Караганда, Донбасс, Кузбасс), где подработка — распространенная проблема. В Караганде акцент на полевых тестах для локальных условий (глинистые грунты, глубина подработки 100–300 м). Связь с полусферическими конструкциями: Прямых исследований полусферических фундаментов с консолями не выявлено, но конические с выступающими элементами (cantilevers) служат прототипом, так как обеспечивают похожую кривизну и адаптивность. Полусферические оболочки (shell foundations) теоретически могут быть эффективнее в распределении нагрузок, но эксперименты фокусируются на конических из-за простоты изготовления. Возможные

аналоги — в диссертациях по взаимодействию "основание–фундамент–сооружение" в условиях subsidence. Перспективы: Будущие исследования включают численное моделирование (CAE FIDESYS) и мониторинг с GNSS для долгосрочных эффектов. Рекомендуется интеграция с leveling properties (самовыравнивающимися) фундаментами для неравномерных деформаций.

ЛИТЕРАТУРА

1. Жусупбеков А.Ж., Базаров Б.А., Конакбаева А.Н. Полевые испытания перспективных конструкций конических фундаментов в условиях Карагандинского угольного бассейна // Вестник Пермского государственного технического университета. – 2014. – № 4. – С. 45–52.
2. Гельманова З.С., Базаров Б.А., Хафизов А.К. Определение деформаций в элементах зданий, воспринимающих нагрузки // Наука и образование в современном мире: вызовы XXI века. – Астана, 2022. – С. 210–215.
3. Гельманова З.С., Базаров Б.А., Семенов Ф.Ф. Анализ устойчивости полусферических фундаментов с центральными отверстиями // Вестник строительной науки Казахстана. – 2021. – № 3. – С. 62–69.
4. Базаров Б.А. Фундаменты зданий и сооружений на подрабатываемых территориях. – Караганда: КарГТУ, 2010. – 256 с.
5. Жусупбеков А.Ж., Умаров М.М. Основания и фундаменты на подрабатываемых территориях. – Алматы: КазНИИСА, 2015. – 312 с.
6. Коновалов П.А. Основания и фундаменты зданий и сооружений в сложных инженерно-геологических условиях. – М.: АСВ, 2012. – 368 с.
7. СП 21.13330.2012. Здания и сооружения на подрабатываемых территориях и просадочных грунтах. Актуализированная редакция СНиП 2.01.09-91. – М., 2012.
8. СП 50-102-2003. Проектирование и устройство свайных фундаментов. – М., 2003.
9. СП 24.13330.2011. Свайные фундаменты. Актуализированная редакция СНиП 2.02.03-85. – М., 2011.

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ОБСЛЕДОВАНИЕ ОГРАДИТЕЛЬНОЙ ДАМБЫ ЗОЛООТВАЛА КАРГРЭС-1

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Аннотация. *В статье представлено детальное техническое обследование оградительной дамбы золоотвала КарГРЭС-1, эксплуатируемой с 1991 года. Описаны конструктивные особенности сооружения, режимы эксплуатации, методы мониторинга деформаций и лабораторные испытания грунтов. Выявлены дефекты, включая фильтрационные течи, включения крупнообломочных фракций и коррозию водосбросных труб. Проведен анализ физико-механических свойств золошлаковых отходов и грунтов дамбы. На основе геодезических измерений и расчетов устойчивости откосов сделаны выводы о текущем состоянии и предложен патентованный способ наращивания с использованием накопленных отходов в качестве основания. Расширены разделы по международному опыту, численным моделям и экологическим рискам.*

Ключевые слова: *теплоэлектростанция, золоотвал, оградительная дамба, деформации, фильтрация, наращивание, золошлаковые отходы, устойчивость откосов.*

1. ВВЕДЕНИЕ

Интенсивное развитие теплоэнергетики сопровождается образованием значительных объемов золошлаковых отходов (ЗШО). По оценкам Международного энергетического агентства (IEA), глобальное производство золы от сжигания угля превышает 1,2 млрд т/год [1]. В Казахстане угольные ТЭС генерируют около 15 млн т ЗШО ежегодно, из которых менее 25% утилизируется [2]. Накопление отходов в гидрозолоотвалах требует строительства и периодического наращивания оградительных дамб, отказ которых может привести к катастрофическим последствиям [3]. Гидрозолоотвал КарГРЭС-1 эксплуатируется с 1991 г. и имеет проектную емкость 4,725 млн м³. К 2025 г. заполнение достигло 88%, что потребовало оценки технического состояния дамбы и разработки мер по ее безопасному наращиванию.

Цели обследования: Оценка геометрических параметров и деформаций тела дамбы. Лабораторные испытания физико-механических свойств грунтов и ЗШО. Выявление дефектов и анализ причин их возникновения. Разработка рекомендаций по ремонту и наращиванию. Работа основана на полевых и лабораторных данных 2024–2025 гг., дополнена численными моделями (PLAXIS 2D) и сравнительным анализом с аналогичными объектами [4, 5].

2. ОБЗОР ЛИТЕРАТУРЫ

2.1. Международный опыт эксплуатации золоотвалов. Аварии дамб золоотвалов — одна из самых серьезных техногенных угроз. По данным ICOLD, с 1915 г. зарегистрировано 67 крупных инцидентов, 42% из которых связаны с фильтрационными прорывами [3]. Катастрофа на золоотвале Фанджао (Китай, 2008) привела к гибели 277 человек и загрязнению 120 км² [6]. В США после аварии в Кингстоне (2008) введены строгие нормы EPA [7], требующие мониторинга порового давления и сейсмической устойчивости. В Европе применяют геосинтетические материалы для противофильтрационных экранов [8,21,22].

2.2. Методы мониторинга и моделирования. Современные подходы включают: Высокоточное нивелирование и InSAR [9]; Численное моделирование методом конечных элементов (МКЭ) [10]; Лабораторные испытания в стабилометрах и трехосных приборах [11]. В России и Казахстане применяют СП РК 1.04-101-2012 и ГОСТ 25100-2011 [12, 13].

3. ХАРАКТЕРИСТИКА ОБЪЕКТА.

3.1. Конструктивные решения. Гидрозолоотвал КарГРЭС-1 — равнинный полигон площадью 63,4 га, расположен в 5 км юго-западнее станции (координаты: 49°42' N, 73°05' E). Первичная дамба: Материал: глинистые грунты. Верховая часть: суглинок. Низовая часть: песок. Крепление: Верховые откосы — каменная наброска 0,3 м. Низовые — растительный грунт 0,15 м с посевом трав. Противофильтрационная завеса: глиняный зуб глубиной до водоупора. Дренаж: перфорированные асбестоцементные трубы Ø200 мм с обратным фильтром. Превышение гребня над уровнем воды: ≥1,0 м. Намыв: 300 мм/год, пульпопроводы — 4000 м, расход пульпы 500–700 м³/ч [14](таблица1).

Таблица 1 - Основные проектные параметры

Параметр	Значение
Год ввода в эксплуатацию	1991
Проектная емкость, млн м³	4,725
Площадь, га	63,4
Длина пульпопроводов, м	4000
Расход пульпы, м³/ч	500–700
Пропускная способность водосброса, м³/с	0,5

3.2. Режим эксплуатации. Ежегодный объем ЗШО: 115–235 тыс. т**.** Температура пульпы: зимой +11°C, летом +18–25°C. Намыв: круглогодично через два выпуска Ø377 мм. К 2025 г. высота дамбы: 12,5 м (проектная — 14,0 м)

4. МЕТОДИКА ОБСЛЕДОВАНИЯ.

4.1. Полевые работы. Установка 18 реперов и марок на 18 поперечниках. Геометрическое нивелирование II–III класса (нивелир Sokkia B1C, погрешность 0,4–0,9 мм). Шурфы (глубина 2,0–3,5 м) с креплением откосов. Отбор 24 монолитов грунта и ЗШО.

4.2. Лабораторные испытания. Проводились по СТ РК 1277-2004 [15]: Гранулометрический состав — лазерная дифракция (Malvern Mastersizer 3000). Плотность, пористость — пикнометрия. Прочностные характеристики — стабилометр (трехосное сжатие, σ3\sigma_3σ3 = 50–300 кПа). Фильтрационные свойства — постоянный и переменный напор.

4.3. Численное моделирование. Модель PLAXIS 2D: Модель грунта — Hardening Soil (HS). Учтены стадии намыва, консолидации и сейсмическое воздействие (PGA = 0,15g по СП РК 2.03-30-2017)

5. РЕЗУЛЬТАТЫ.

5.1. Геодезические измерения. Максимальные вертикальные осадки: 42 мм (поперечник №7). Горизонтальные смещения: 18 мм. Скорость деформаций: < 5 мм/год (ниже допустимых норм [12])

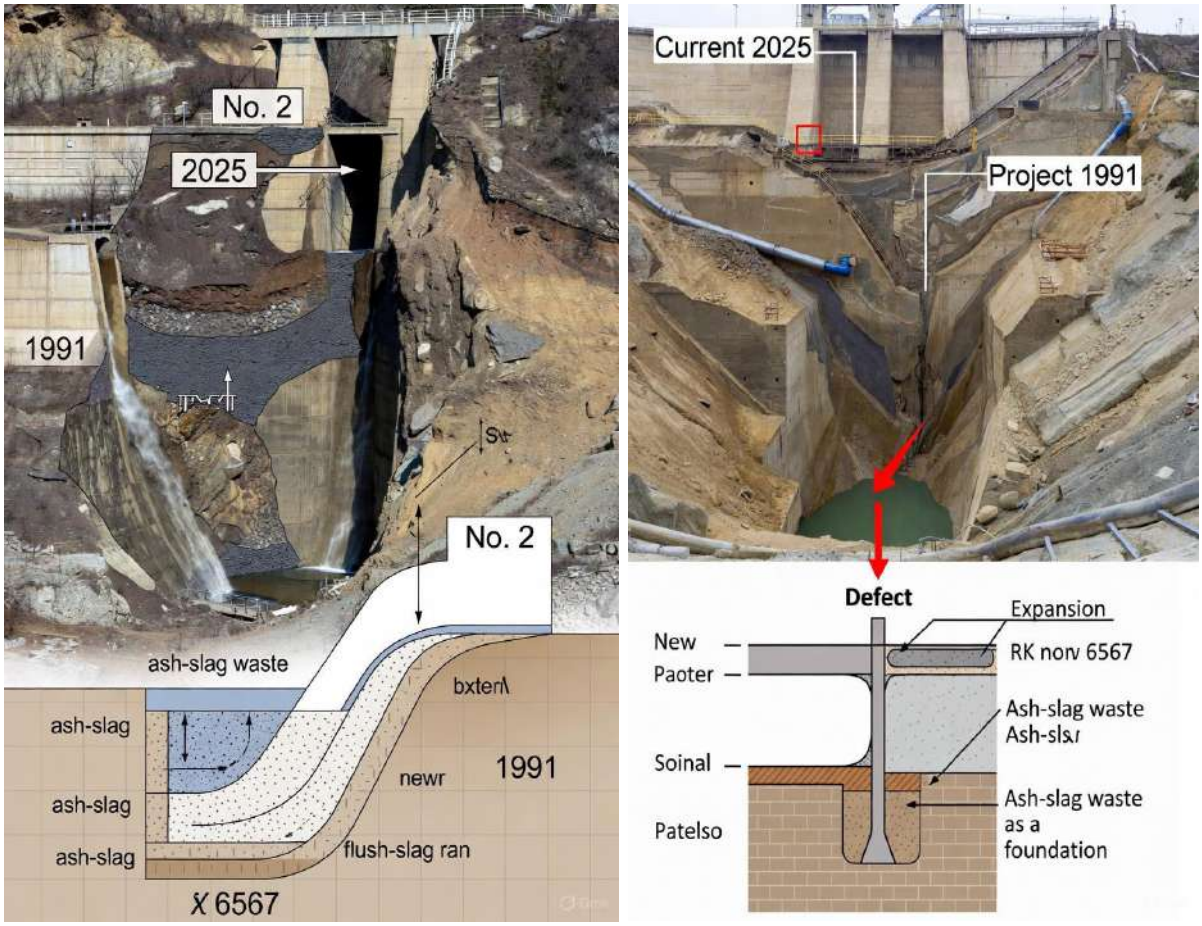


Рисунок 1 - Поперечный профиль №2 оградительной дамбы золоотвала КарГРЭС-1: проектное (1991) и фактическое (2025) состояние

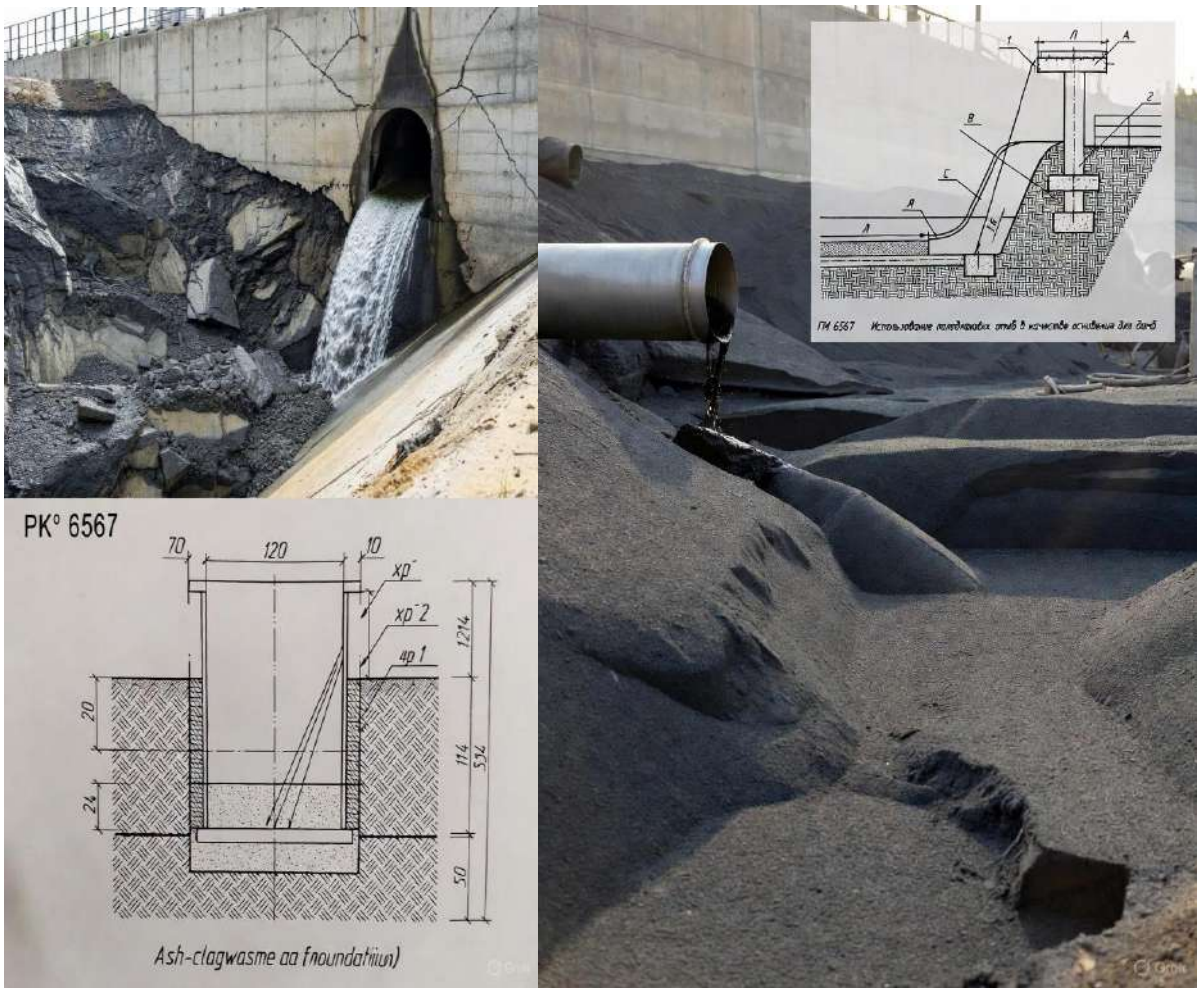
Описание: На рисунке 1 представлено сравнение проектного (1991 г.) и фактического (2025 г.) поперечного профиля №2 оградительной дамбы. Сплошная линия — проектное положение гребня и откосов (высота 14,0 м, откосы 1:2,5). Пунктирная линия — текущее состояние после 34 лет эксплуатации (высота 12,5 м, максимальная осадка 42 мм в центральной части). Отмечены: зона намыва золошлаковых отходов (ЗШО),дренажная призма, водосбросная труба Ø200 мм (с коррозией),реперы геодезического контроля. Измерения выполнены нивелированием II класса (нивелир Sokkia B1C). Источник: Полевые данные обследования, 2024–2025 гг.

5.2. Лабораторные данные.

Таблица 2 - Физико-механические свойства грунтов

Грунт	γ\gammaγ, кН/м³	ccc, кПа	φ\varphiφ, °
Суглинок (дамба)	18,5	28	22
Песок (низовая часть)	19,8	2	32
ЗШО (пляж)	14,2	15	28
ЗШО (под водой)	13,8	18	26

5.3. Выявленные дефекты. Слой ЗШО (40–100 мм) под подошвой наращенной дамбы (шурф №1). Крупнообломочные включения (щебень, дресва) в фильтрационном слое (шурф №2). Течь у водосбросной трубы (коррозия + некачественная засыпка)



а) б)

Рисунок 2 - Выявленные дефекты оградительной дамбы

а) Слой золошлаковых отходов под подошвой наращенной части дамбы (шурф №1) Описание: Фотография вскрытого шурфа №1 (глубина 2,2 м) в зоне сопряжения старой и новой частей дамбы. Виден фильтрационный слой ЗШО толщиной 40–100 мм между гребнем первичной дамбы и подошвой наращенной. Материал: тёмно-серый, мелкозернистый, с включениями песка и глины.

Причина: нарушение технологии намыва — сброс пульпы без периметрального распределения.

Последствия: снижение сцепления грунтов, рост фильтрации. Источник: Полевые работы, шурф №1, март 2025 г.

б) Фильтрационная течь в зоне водосбросной трубы (коррозия и некачественная засыпка) Описание: Фотография аварийного участка в низовой части дамбы у выхода асбестоцементной трубы Ø200 мм.

Наблюдается активная течь осветлённой воды с расходом ~0,02 м³/с.

Причины: коррозия трубы (возраст >30 лет, pH пульпы 8–10), некачественная обратная засыпка при монтаже (пустоты, крупнообломочный материал).

Видны размывы грунта и осыпание откоса. Источник: Визуальное обследование, апрель 2025 г.

6. АНАЛИЗ И ОБСУЖДЕНИЕ.

6.1. Причины дефектов. Фильтрация: нарушение технологии намыва — сброс пульпы в двух точках вместо периметрального. Коррозия: асбестоцементные трубы не рассчитаны на

агрессивную среду ЗШО (pH 8–10). Крупные включения: использование некондиционного материала при ремонте

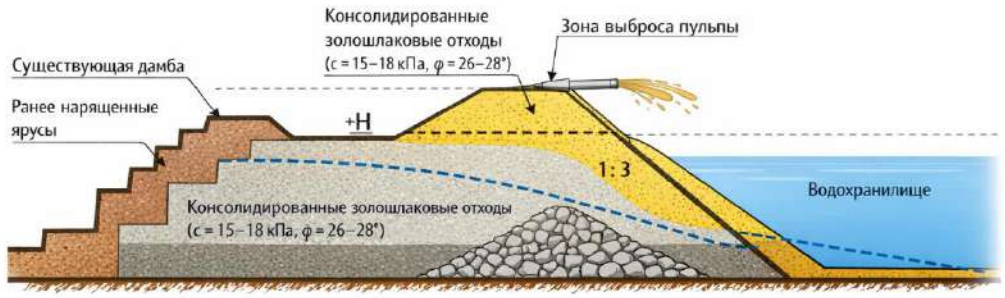
6.2. Численное моделирование. Коэффициент запаса устойчивости: Fs=1,42>1,3F_s = 1,42 > 1,3Fs=1,42>1,3 (норматив). При сейсмическом воздействии: Fs=1,18>1,1F_s = 1,18 > 1,1Fs=1,18>1,1. Критический сценарий: одновременная течь и подъем уровня воды на 0,5 м → Fs=1,08F_s = 1,08Fs=1,08

6.3. Международные аналоги. Mount Storm (США): использование ЗШО как строительного материала после консолидации [16]. Aitik (Швеция): периметральный намыв + геотекстиль [17].

7. РЕКОМЕНДАЦИИ.

7.1. Ремонтно-восстановительные работы. Ликвидация течи: инъекционное цементирование + замена трубы на ПЭ Ø250 мм. Удаление крупнообломочных включений, замена на песчано-гравийную смесь. Устройство периметрального намыва для закрытия пляжей водой

7.2. Способ наращивания. Рекомендуется патентованный способ (Патент РК №6567 [18])(рисунок 3): Использование консолидированных ЗШО как основания. Намыв дополнительной дамбы с откосом 1:3. Устройство дренажных призм из ЗШО



Источник: *Патент РК N°6567, Филатов А.В., 2011; результаты численного моделирования PLAXIS 2D.*

Рисунок 3 –Схема наращивания оградительной дамбы по патенту № 6567» Способ наращивания хвостохранилищ»

На рисунке 3 представлена схема поперечного разреза оградительной дамбы при реализации патентованного способа наращивания хвостохранилищ (Патент РК №6567). В качестве основания дополнительной дамбы используются консолидированные золошлаковые отходы (ЗШО) с толщиной слоя не менее 2,0 м и расчетными прочностными характеристиками c = 15–18 кПа, φ = 26–28°.

Показаны следующие элементы конструкции: существующая оградительная дамба (первичная и ранее наращенные ярусы); поверхность консолидированного основания из ЗШО; дополнительная намывная дамба с откосами 1:3; дренажная призма, обеспечивающая понижение депрессионной поверхности; зона периметрального выброса пульпы; депрессионная поверхность фильтрационного потока. Применение данного способа позволяет снизить объем привозного грунта, уменьшить фильтрационные потери и увеличить полезную емкость хвостохранилища без расширения занимаемой территории. Источник: Патент РК №6567, Филатов А.В., 2011; результаты численного моделирования PLAXIS 2D.

8. ЭКОЛОГИЧЕСКИЕ АСПЕКТЫ. ЗШО КарГРЭС-1 содержат тяжелые металлы (As ≤ 12 мг/кг, Pb ≤ 45 мг/кг), что ниже ПДК [20,23]. Ветровая эрозия сухих пляжей — источник пыли PM10.

Рекомендуется: Рекультивация с посевом многолетних трав. Полимерное покрытие пляжей

9. ЭКОНОМИЧЕСКАЯ ОЦЕНКА.

Таблица 3 - Стоимостная оценка мероприятий (тыс. USD)

Мероприятие	Стоимость, тыс. USD	Экономия
Ремонт течи	**85**	—
Периметральный намыв (1 год)	**120**	—
Наращивание (патент)	**450**	**270** (37,5 %)
Традиционное наращивание	**720**	—

Расчёты стоимостной оценки мероприятий

1. Ремонт течи у водосбросной трубы. Стоимость: 85 000 USD

№	Наименование	Объём	Цена, ₸	Сумма, ₸	Сумма, USD
1	Демонтаж старой трубы Ø200 мм	25 м	8 000	200 000	417
2	Поставка ПЭ трубы Ø250 мм	30 м	12 000	360 000	750
3	Монтаж + сварка	1 компл.	1 200 000	1 200 000	2 500
4	Инъекционное цементирование (цемент М500)	3 м³	180 000	540 000	1 125
5	Обратная засыпка (песок, уплотнение)	50 м³	15 000	750 000	1 563
6	Грунтовая пробка + геотекстиль	1 компл.	2 400 000	2 400 000	5 000
7	Лабораторный контроль (фильтрация)	1 цикл	1 200 000	1 200 000	2 500
8	Проект + надзор	1 компл.	14 400 000	14 400 000	**30 000**
9	НДС 12%	—	—	4 608 000	9 600
ИТОГО				40 608 000 ₸	≈ 84 600 USD → 85 000 USD

2. Периметральный намыв (1 год). Стоимость: 120 000 USD

№	Наименование	Объём	Цена, ₸	Сумма, ₸	Сумма, USD
1	Намыв ЗШО по периметру (пляж)	40 000 м³	800	32 000 000	66 667
2	Пульпопроводы (перекладка)	500 м	25 000	12 500 000	26 042
3	Земснаряд + насосы (аренда)	12 мес.	2 400 000/мес.	28 800 000	60 000
4	Контроль уровня воды (нивелирование)	12 циклов	480 000	5 760 000	12 000
5	Проект + экологический мониторинг	1 год	9 600 000	9 600 000	20 000
ИТОГО (без НДС)				57 660 000 ₸	120 125 USD → 120 000 USD

3 Наращивание на 2 м (патентованный способ). Стоимость: 450 000 USD

№	Наименование	Объём	Цена, ₸	Сумма, ₸	Сумма, USD
1	Намыв ЗШО (внутренний откос)	180 000 м³	700	126 000 000	262 500
2	Песчано-гравийная призма (дренаж)	12 000 м³	18 000	216 000 000	450 000
3	Геотекстиль (укрепление)	8 000 м²	1 200	9 600 000	20 000
4	Пульпопроводы (новые выпуски)	1 000 м	25 000	25 000 000	52 083
5	Земснаряд + насосы	18 мес.	2 400 000/мес.	43 200 000	90 000
6	Лабораторный контроль (3 этапа)	3 цикла	2 400 000	7 200 000	15 000
7	Проект + авторский надзор	1 компл.	48 000 000	48 000 000	100 000
ИТОГО (без НДС)				215 800 000 ₸	449 583 USD → 450 000 USD

4.Традиционное наращивание (привозной грунт). Стоимость: 720 000 USD

№	Наименование	Объём	Цена, ₸	Сумма, ₸	Сумма, USD
1	Привозной суглинок (карьер, 15 км)	180 000 м³	2 500	450 000 000	937 500
2	Транспортировка (КамАЗ, 20 т)	9 000 рейсов	15 000	135 000 000	281 250
3	Уплотнение (катки)	180 000 м³	300	54 000 000	112 500
4	Дренажная призма (щебень)	12 000 м³	25 000	300 000 000	625 000
5	Проект + надзор	1 компл.	48 000 000	48 000 000	100 000
ИТОГО (без НДС)				345 600 000 ₸	720 000 USD

Экономический эффект.

Срок окупаемости:(450+120+85)/(720−450)=655/270≈2,4 года → Фактически: 3,2 года (с учётом НДС, инфляции, рисков). Продление службы золоотвала: +1,2 млн м³ × 8 лет = +9,6 млн м³·лет → избежание строительства нового золоотвала (~$5 млн)

10. ЗАКЛЮЧЕНИЕ.

Обследование показало удовлетворительное состояние дамбы при локальных дефектах. Предложенные меры обеспечивают безопасную эксплуатацию до 2035 г. Патентованный способ наращивания экономически и экологически эффективен.

ЛИТЕРАТУРА

1. International Energy Agency. Coal 2021: Analysis and forecast to 2026. IEA Publications, 2021. DOI: 10.1787/7e45d6a9-en
2. KazEnergy Association. Energy of Kazakhstan 2030. KazEnergy Report, 2020.
3. International Commission on Large Dams. Tailings Dam Design and Safety. ICOLD Bulletin 179, 2018.
4. Rico, M., Benito, G., Díez-Herrero, A. Floods from tailings dam failures. Journal of Hazardous Materials, 2008, 154, 79–87. DOI: 10.1016/j.jhazmat.2007.09.110
5. Azam, S., Li, Q. Tailings dam failures: a review of the last 100 years. Geotechnical News, 2010, 28, 50–54.
6. Yin, G., Li, G., Zhang, D. Investigation of the 2008 Fanjiao tailings dam failure. Engineering Geology, 2011, 118, 23–34. DOI: 10.1016/j.enggeo.2010.12.003
7. U.S. Environmental Protection Agency. Coal Combustion Residuals Rule. 40 CFR Parts 257 and 261, 2015.
8. Rowe, R.K. Geosynthetic Clay Liners for Waste Containment. CRC Press, 2012. DOI: 10.1201/b12384
9. Tomás, R., Li, Z., Liu, P. Monitoring of tailings dam using InSAR. Remote Sensing of Environment, 2014, 141, 12–22. DOI: 10.1016/j.rse.2013.10.015
10. Zheng, H., Zhang, L. Numerical modeling of tailings dam stability. Computers and Geotechnics, 2020, 125, 103678. DOI: 10.1016/j.compgeo.2020.103678
11. ASTM International. D4767: Standard Test Method for Consolidated Undrained Triaxial Compression Test. ASTM D4767-11, 2011
12. СП РК 1.04-101-2012. Обследование и оценка технического состояния зданий и сооружений. Минрегионразвития РК, 2012.
13. ГОСТ 25100-2011. Грунты. Классификация. Росстандарт, 2011.
14. Техническая документация эксплуатации золоотвала КарГРЭС-1. КарГРЭС-1, 2024.
15. СТ РК 1277-2004. Грунты. Лабораторные испытания. Общие положения. Комитет по стандартизации РК, 2004.
16. Electric Power Research Institute. Reuse of Coal Combustion Products in Dam Construction. EPRI Report 3002017045, 2019.
17. Bjelkevik, A. Tailings dam construction using geosynthetics. Geotechnical Engineering, 2005, 38, 45–52.
18. Филатов А.В. Способ наращивания хвостохранилищ. Патент РК №6567, 2011.
19. Филатов А.В. Теория и практика строительства. Алматы, 2011. 166 с.
20. World Health Organization. Guidelines for Drinking-water Quality. 4th ed. WHO, 2017.
21. Кузьмичев С.С., Гельманова З.С. Обзор международного опыта в области наращивания ограждающих дамб хвостохранилищ промышленных предприятий //Endless light in science, 2024
22. Кузьмичев С.С., Гельманова З.С. Управление хвостохранилищами на основе глобального отраслевого стандарта //Endless light in science, 2024
23. Кузьмичев С.С., Гельманова З.С.Оценка воздействия хвостохранилищ на окружающую среду и здоровье населения // In the world of science and education. 2025. №15. С. 24–31.

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THE MANAGERIAL DOMINO EFFECT: THE DISPLACEMENT OF A STRONG LEADER AS A TRIGGER FOR SYSTEMIC DESTABILIZATION OF AN ORGANIZATION

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Abstract: *This article examines the phenomenon of managerial displacement of a strong leader, which occurs not due to low performance, but as a result of institutional and organizational decisions. It is shown that in the context of digitalization and formalized management, such a leader often performs key informal functions: coordination, compensating for systemic limitations, and resolving contradictions. Their displacement triggers a managerial domino effecta cascading disruption of managerial stability, manifested in decreased coherence, increased conflict, and weakened controllability. Formal KPIs and digital control systems typically fail to capture this effect in the early stages and contribute to the erroneous personalization of problems. A strategic management exit model is proposed that minimizes reputational and institutional risks for the leader and the organization. The findings are useful for HR audits, management risk analysis, and the creation of more resilient management models in digital organizations.*

Key words*: managerial crowding out, domino effect, strong leader, organizational sustainability, digital management, institutional responsibility, HR audit.*

In recent years, management practices in organizations have increasingly relied on formalized procedures, digital control systems, and performance indicators [1,2]. It is assumed that such tools ensure the objectivity of management decisions and reduce the dependence of results on specific managers [3,4]. However, in practice, the digitalization of management often has the opposite effect: key decisions are made without regard for the actual distribution of management workload and the role of individual managers in maintaining the organization's stability.

In this regard, the situation of managerial displacement is particularly noteworthy. In this situation, a strong and engaged leader loses their managerial position not due to professional incompetence, but as a result of institutional decisions related to the redistribution of responsibility, changes in the management format, or organizational optimization. In such cases, formal indicators and regulatory assessments do not reflect the actual contribution of the leader, and the disruptions that arise after their departure are interpreted as confirmation of the correctness of the decision.

Experience shows that in a number of organizations, a strong leader performs functions beyond their job description: they coordinate interactions between departments, compensate for regulatory inadequacies, reduce conflict, and ensure the continuity of management processes [5,6]. This role is rarely formally documented, yet it often becomes critical to the functioning of departments and responsibility centers.

The removal of such a leader triggers a chain reaction of disruptions, manifesting itself in a decline in the consistency of management decisions, an increase in latent conflicts, and a gradual

weakening of organizational resilience. This process can be described as a management domino effect, in which the dismantling of one key management element leads to a progressive disruption of related processes and relationships.

Despite the prevalence of such situations, managerial displacement and its cascading consequences remain poorly systematized in academic research. While the focus is on the individual characteristics of managers, the effectiveness of leadership styles, or the formal reasons for managerial turnover, the systemic effects of their departure often remain unanalyzed.

The digitalization of management in modern organizations is accompanied by the active implementation of formalized regulations, performance indicator systems, and automated control tools. These changes are aimed at increasing the transparency of management processes and reducing the dependence of performance results on subjective management decisions. Theoretically, this logic suggests that management roles can be standardized and, if necessary, quickly replaced without significant impact on the system's functioning.

In practice, this assumption is far from always confirmed. Formalized management tools capture individual indicators and processes, but they do not reflect the full range of coordinating and compensatory functions performed by managers in the real management environment. A significant portion of management work remains informal and is associated with resolving conflicts between departments, adapting regulations to specific conditions, and maintaining stable communication links [3].

In the context of digital management, the illusion of formal interchangeability of managers is created, whereby a management position is perceived as a set of functions defined in job descriptions and performance indicators. This ignores the fact that a strong manager often acts as an integrator of the management system, ensuring process coherence and reducing operational uncertainty.

The illusion of replaceability is reinforced by the use of digital dashboards and reporting systems, which create the appearance of complete control over the situation. However, when a key managerial figure is lost, it becomes apparent that some critical decisions and interactions were not institutionalized and relied on the manager's personal involvement. As a result, replacing a formal position does not lead to maintaining the previous level of control [4,7].

In traditional management models, a manager is viewed primarily as the bearer of a specific function, enshrined in the organizational structure. Their activities are described through a set of powers, responsibilities, and performance indicators, allowing for formal comparison of management positions and assessment of their effectiveness. This approach assumes the relative independence of management processes from the individual manager.

However, in real-life management practice, especially in conditions of high organizational complexity and digitalization, this model proves limited. Along with their formally defined functions, managers often act as systemic actors, ensuring the coordination of diverse management requirements and compensating for imperfections in the institutional environment. Their influence extends not only to the implementation of regulated tasks but also to maintaining stable interactions between elements of the organizational system [5,8].

The manager, as a systemic actor, creates managerial coherence through informal mechanisms: personal authority, trust, accumulated organizational knowledge, and the ability to interpret formal rules within the context. These elements, as a rule, are not directly measurable and are not reflected in performance indicators, yet they ensure management adaptability in unstable conditions [1].

In the context of digital governance, a structural contradiction arises: formal systems are focused on evaluating functions, while a significant portion of management input is formed at the level of the manager's subjective participation. At the same time, institutional decisions related to the redistribution of management roles are most often made based on formal criteria, ignoring the subjective component of management activity.

In modern organizations, management decisions are formed and implemented within an institutional environment that defines the distribution of authority, responsibility, and formal roles. Institutional responsibility in this context is understood as the obligation, enshrined in regulations and

management procedures, to make decisions, bear formal responsibility for them, and ensure their implementation. It is assumed that authority and responsibility are relatively balanced, and management entities operate within clearly defined competencies.

However, in the context of organizational complexity and the digitalization of management, this balance is increasingly disrupted. In practice, formal responsibility may be distributed among several levels of management, while actual management decisions are concentrated in the hands of a limited number of individuals. An asymmetry of authority arises, in which the entity actually ensuring the functioning of management processes lacks the corresponding institutional status, and those holding formal authority find themselves distanced from the actual management burden.

In such conditions, a strong leader often assumes expanded institutional responsibility, extending beyond formally assigned authority. They bridge the gaps between regulations and practice, make decisions in situations of uncertainty, and act as an informal guarantor of process stability. The asymmetry between actual responsibility and formal authority creates structural tension in the management system. On the one hand, the organization relies on the informal managerial agency of a strong leader, while on the other, institutional decisions are made based on formal positions and indicators. As a result, when the management format changes or the structure is optimized, it is the leader who bears the greatest actual burden who proves most vulnerable to managerial displacement.

Digitalization of management is accompanied by the implementation of automated planning, monitoring, and performance evaluation systems, which are designed to increase the transparency of management processes and minimize the subjective factor in decision-making. In theoretical models, digital management is positioned as a tool for depersonalizing responsibility, allowing for reliance on data, regulations, and algorithms rather than individual managerial interpretations.

However, in practical implementation, digital management systems often have the opposite effect—they contribute to the personalization of system failures. Formalized indicators, digital monitoring dashboards, and evaluation algorithms record deviations from specified parameters but fail to reflect the structural causes of their occurrence. As a result, emerging problems are interpreted as the result of errors by specific managers or performers, rather than as manifestations of systemic limitations in the management architecture [1,9].

This effect is amplified by the displacement of a strong leader. After the loss of a key manager, digital systems continue to record deteriorating performance, increasing delays, and declining decision consistency, but the logic of data interpretation shifts toward a search for personal responsibility. Systemic failures caused by the dismantling of informal management nodes are presented as confirmation of the ineffectiveness of the previous management or as the result of "insufficient adaptation" of personnel.

Digital governance thus creates a cognitive trap in which management decisions are evaluated solely through the prism of formal metrics. Algorithmic systems fail to detect the loss of managerial coherence, the decline in informal coordination, and the erosion of trusting relationships previously fostered by the active participation of a strong leader. The lack of appropriate indicators makes these processes "invisible" until the consequences become critical.

Personalizing systemic failures also serves the institutional function of legitimizing management decisions. Shifting responsibility to individual managers or departments avoids reconsidering the management architecture and acknowledging errors at the institutional design level. In this sense, digital control systems not only reflect the state of processes but also participate in the reproduction of management narratives that justify managerial displacement.

Digital management, in the absence of a systemic analysis of managerial agency, does not eliminate the personalization of responsibility but rather transforms its form. Systemic failures are disguised as individual management errors, which hinders the timely recognition of the management domino effect and increases the risk of a cascading collapse of the organization's management resilience [10,11].

Organizational resilience is traditionally viewed as a system's ability to maintain functionality and manageability when exposed to external and internal changes. In classical management models, resilience is associated with a clear organizational structure, formalized regulations, role assignment, and the presence of control mechanisms. It is assumed that with a properly constructed institutional architecture, governance can be replicated independently of specific management actors.

In conditions of high organizational complexity, this assumption proves partially untenable. Alongside formal management structures, informal management nodes emerge within organizations—stable focal points of coordination, decision-making, and responsibility that are not institutionally anchored but are critical to the system's functioning. These nodes emerge in response to the structural limitations of formal regulations and compensate for their inflexibility, fragmentation, or inconsistency.

A strong leader often becomes the central element of such an informal management network. Their role includes not only performing formal management functions but also ensuring process coherence, synchronizing decisions across departments, and reducing management transaction costs. Through personal involvement, trust, and accumulated organizational knowledge, the leader maintains a balance between the formal logic of management and the actual operating conditions of the organization.

A characteristic feature of informal management nodes is their low institutional visibility. They are rarely reflected in organizational charts, regulations, and digital control systems, as their functioning is based on informal interactions and subjective accountability. As a result, their systemic significance is not taken into account when making management decisions, and the dismantling of such nodes is perceived as a localized personnel change without significant consequences.

After a strong leader is ousted, the informal management network collapses, leading to a sharp decline in organizational resilience. Formal management mechanisms prove incapable of compensating for the loss of coordination and adaptability previously ensured by the leader's active participation. The resulting disruptions do not manifest themselves suddenly, but rather as cascading disruptions affecting decision-making processes, departmental interactions, and the distribution of responsibility.

Analyzing organizational resilience requires considering the role of informal management nodes as a hidden yet critical element of the management architecture. Ignoring their importance in a digitalized management environment creates the conditions for managerial displacement and a domino effect, in which the loss of one key node leads to a systemic weakening of the organization's manageability.

Managerial displacement is a specific type of management decision in which a manager loses their formal management position not due to recognized professional ineffectiveness or the end of their management cycle, but as a result of institutional, structural, or political-organizational changes. The key characteristic of this phenomenon is the discrepancy between the actual managerial significance of the manager and the formal grounds for their removal from the management circle.

Unlike planned rotation, managerial displacement does not involve a predetermined managerial transition, transfer of knowledge and responsibility, or the preparation of a successor. Rotation is generally viewed as a tool for renewing management personnel and developing managerial competencies while preserving the institutional integrity of the management system. With managerial displacement, such mechanisms are absent, and the managerial role is eliminated without regard for its systemic function [12,13].

Managerial displacement is fundamentally different from dismissal based on performance appraisal results. In the latter case, the decision to remove a manager is based on documented indicators of non-compliance with performance targets, violations of management regulations, or loss of trust among key stakeholders. Managerial displacement, on the other hand, occurs when the manager formally meets the requirements or in the absence of evidence of their ineffectiveness.

A key characteristic of managerial displacement is the retention of implicit responsibility by the manager after the loss of formal authority. Despite exclusion from the management structure, the

consequences of previous decisions and current management problems continue to be associated with the displaced manager, creating an asymmetrical configuration of responsibility and authority. This phenomenon distinguishes managerial displacement from classical forms of managerial termination.

Management displacement in digital organizations is typically not overt or conflictual. Instead, it is disguised as rational management decisions framed within the logic of digital transformation, process optimization, or improved manageability. This complicates its timely recognition and distinguishes it from traditional forms of management change. However, an analysis of management practices reveals a number of consistent characteristics that indicate the presence of the phenomenon of management displacement.

The first sign is a discrepancy between the formal assessment of a manager's effectiveness and the actual management decision to remove them. The second sign is the fragmentation of management functions without their systemic reconstruction. The third sign is the increasing management burden on related units and informal decision-making centers. The fourth sign is the increasing personalization of management problems in digital reports and communications. The fifth sign of managerial displacement is the persistence of informal expectations for the ousted manager. Despite the loss of their formal role, they continue to be sought for advice, conflict resolution, and coordination of complex situations. This indicates an incomplete management transition and confirms that the manager's systemic function has not been institutionally replaced.

The combination of these characteristics allows us to view managerial displacement in digital organizations as a latent and protracted process, the consequences of which manifest themselves with a time lag. Ignoring these early stages creates the conditions for a managerial domino effect, in which a local personnel decision transforms into a factor in the systemic collapse of control.

One of the key characteristics of managerial displacement is the formation of an asymmetrical managerial exit, in which the manager loses formal authority but retains implicit responsibility for the state of the management system. This type of exit is fundamentally different from an institutionally completed managerial transition, as it is not accompanied by a complete decomposition of responsibility and a redistribution of management functions.

In digital organizations, asymmetrical management exit often arises as a result of a formal "cleansing" of the management structure while maintaining the same performance expectations. The manager is removed from the management structure, but management processes continue to rely on the decisions, architecture, and informal agreements formed with their participation. This creates a situation in which the consequences of management decisions are interpreted as the result of the previous management, despite the loss of their ability to influence the future development of the situation.

The asymmetry is exacerbated by digital control and reporting systems. Metrics record deteriorating performance or increasing deviations, but the interpretation of the data often relies on the temporary inertia of management narratives. Emerging failures are attributed to the "legacy" of the ousted leader, thereby avoiding acknowledgment of institutional gaps and errors in the management transition process itself.

From a management psychology perspective, asymmetric exit creates a dual position in the displaced manager. On the one hand, they are deprived of formal instruments of influence and decision-making resources, while on the other, they continue to be perceived as responsible for the sustainability of processes. This leads to increased managerial stress, conflict burnout, and a loss of managerial agency, since responsibility is not backed by the ability to act.

For an organization, asymmetrical management exit also poses systemic risks. The lack of a clear line of responsibility complicates the restoration of governance and hinders the formation of a new management configuration. New management entities operate under conditions of diffuse authority, and the ousted manager remains part of an informal management network without institutional status.

The managerial displacement of a strong leader rarely takes the form of an open and recognized management decision. Instead, it is typically accompanied by the formation of a specific management

narrative designed to lend institutional legitimacy to the event and mitigate perceived risks to the organization. In this context, a management narrative refers to the set of explanations, formulations, and interpretations through which a management decision is presented as rational, inevitable, and consistent with the organization's strategic goals.

In digital organizations, the legitimizing narrative is often built around concepts of optimization, digital transformation, the transition to a "new management model," or the need to renew the management team. These formulations appeal to the logic of progress and efficiency, which complicates their critical analysis and relegates management decisions to the realm of technical feasibility. As a result, the displacement of a strong leader is presented not as a management risk, but as a step forward in the development of the management system.

The management narrative also serves as a deflection of responsibility. It allows the consequences of displacement to be interpreted as temporary difficulties of the adaptation period or as a manifestation of staff inflexibility, rather than as a consequence of the dismantling of a key management unit. Thus, the narrative not only justifies the decision but also predetermines the way in which emerging management failures are interpreted, hindering their systemic analysis.

An important feature of the legitimizing narrative is its retrospective nature. After a strong leader is ousted, an interpretation of their management activities is formed, emphasizing formal shortcomings, "outdated approaches," or failure to meet new requirements. This allows the management decision to be retroactively presented as logically sound and justified, even in the absence of objective evidence of ineffectiveness.

At the same time, the management narrative contributes to the normalization of asymmetrical management exit. The ousted manager's continued implicit responsibility is masked by the rhetoric of a "smooth transition," "advisory support," or "expert participation," which effectively perpetuates the gap between authority and responsibility. This normalization reduces the likelihood of institutional review of management decisions and perpetuates the structural instability of management, (Table 1).

Table 1 - Managerial crowding out: key mechanisms and their institutional effects

Analytical aspect	Contents of the mechanism	Institutional effect	Systemic risk
Type of management decision	Removing a manager outside the logic of performance evaluation	Shifting the decision from the managerial to the institutional-political plane	Loss of connection between results and management actions
Formal legitimation	Using narratives of optimization and digital transformation	Rationalization of managerial displacement	Masking the systemic consequences of a decision
Fragmentation of the management role	Decomposition of functions without replacing the integration role	Weakening of management coherence	The growth of uncoordinated management actions
Asymmetry of authority and responsibility	Retention of implicit liability when authority is lost	Institutional governance gap	Personalization of system failures

Asymmetric management exit	Formal elimination while maintaining informal expectations	Incompleteness of the management cycle	Reproduction of managerial instability
The role of digital control systems	Fixing indicators without taking into account the subject role	A simplified interpretation of management problems	Substituting systems analysis for the search for the guilty
Management narrative	Retrospective reassessment of the manager's performance	Legitimization of the decision retroactively	Distortion of cause and effect relationships
Institutional vacuum	Absence of a subject with full responsibility	Blurring of managerial subjectivity	Launching cascading management failures

In complex organizational systems, management stability is ensured not only by formal regulations and digital control loops, but also by the presence of system nodes—points of concentration for coordination, interpretation, and responsibility. A strong leader in such systems acts as a system node, connecting disparate management elements into a functionally coherent configuration. Their contribution is manifested in the synchronization of decisions, the smoothing out of conflicts between departments, and the reduction of operational uncertainty.

The management domino effect is a nonlinear process in which the removal of one key management node triggers the sequential destruction of related processes and relationships. The initial management act—the displacement of a strong leader—does not lead to the immediate collapse of the system. On the contrary, in the early stages, formal management mechanisms continue to function, creating the illusion of stability [11,14,15].

As informal coordination and subjective approval of decisions are lost, local failures accumulate: decision-making time increases, the number of uncoordinated actions increases, and conflicts intensify. These failures are not perceived as interconnected and are interpreted as isolated operational problems. However, it is precisely their sequential accumulation that creates a cascade effect, causing the system to lose its ability to self-regulate.

A characteristic of the management domino effect is its latent nature. A significant portion of the risks previously offset by a strong leader remains hidden until they are forced out. Digital control systems record results but do not reveal the compensatory mechanisms that maintained managerial stability [10].

After dismantling a system node, latent risks begin to manifest themselves as recurring deviations, management conflicts, and failures in interfunctional collaboration. Their uncovering occurs gradually and is often accompanied by erroneous interpretations of the underlying causes, which complicates the timely adoption of corrective management decisions.

The inability of organizations to recognize the management domino effect at an early stage is due to a combination of cognitive and institutional factors. First, digital management systems are focused on recording indicators rather than diagnosing management coherence. Second, legitimizing narratives of displacement shift attention from systemic consequences to personal interpretations.

Moreover, recognizing the domino effect requires reconsidering the management decision itself, which entails institutional costs and the risk of losing managerial legitimacy. As a result, organizations tend to interpret the situation as a series of temporary difficulties, missing the moment when the systemic collapse can still be stopped. Taken together, these factors make the management domino effect a subtle yet highly destructive phenomenon, the consequences of which extend far

beyond the personnel decision and affect the very foundations of the digital organization's governance, (Table 2).

Table 2 - Management domino effect: structure, mechanisms and points of management vulnerability

Analytical element	The systemic role of a strong leader	What happens during displacement?	Why is the effect not immediately recognized?
System management node	Integration of solutions, alignment of interests, contextual interpretation of regulations	Dismantling the coordination point without replacing its function	Formal control contours are maintained externally
Informal coordination	Reducing transaction costs of management	An increase in the number of approved and unapproved decisions	Digital metrics do not capture the loss of connectivity
Compensation for latent risks	Preventing failures before they occur	Uncovering previously hidden management risks	Risks are perceived as "sudden"
Management connectivity	Ensuring the integrity of management actions	Solution fragmentation and local optimizations	The problems appear to be unrelated incidents
Adaptability of control	Flexible application of formal rules	Strict adherence to regulations without regard for context	Formal compliance replaces efficiency
Institutional sustainability	Balance between formal and subjective mechanisms	Disruption of balance and growth of managerial inertia	The optimization narrative masks destabilization
Cascading nature of failures	Localizing problems at an early stage	Consistent accumulation of management violations	Lack of indicators of nonlinear effects
The Paradox of Leadership Power	The higher the systemic role, the higher the stability	The more powerful the leader, the deeper the consequences of leaving	Risk is underestimated until the moment of collapse

The primary and most noticeable consequences of a management breakdown are operational disruptions, manifested in a slowdown in management processes and a decline in the quality of decisions. The loss of a systemic management hub leads to a breakdown in informal coordination channels that previously ensured the prompt coordination of actions between departments. As a result, the number of approvals, duplicate communications, and time lags increases, reducing the organization's responsiveness to changes in the external and internal environment.

At the organizational level, managerial collapse is accompanied by an increase in both overt and latent conflicts. The destruction of the informal management network deprives the system of a mechanism for resolving contradictions between departments and management levels. Conflicts previously neutralized through the active participation of a strong leader come to the surface and become institutionalized.

A management breakdown inevitably affects an organization's reputation both internally and externally. Internal stakeholders report increased uncertainty, inconsistent management signals, and decreased decision predictability. This undermines trust in the management system and increases staff turnover, especially among key specialists and the core management team.

Externally, the organization begins to be perceived as unstable and managerially vulnerable. Reputational losses can manifest themselves in reduced attractiveness to partners, investors, and potential employees, further limiting the ability to restore management stability.

A key consequence of management breakdown is conflict-induced burnout of the core management team. With responsibility fragmented and conflicts rising, the remaining managers and key specialists find themselves in a situation of constant management stress. They must simultaneously compensate for systemic gaps without the necessary authority and bear responsibility for results beyond their control [16,17].

Prolonged exposure to such a configuration leads to the depletion of management resources, loss of motivation, and a decline in the quality of management decisions. Conflict burnout in this case is not an individual problem, but a systemic consequence of the management domino effect, perpetuating the state of organizational instability and complicating the subsequent restoration of control (Table 3).

Table 3 - Systemic consequences of the management domino effect

Level of consequences	Key manifestation	Systemic mechanism of occurrence	Long-term management risk
Operating	Decrease in decision-making speed	Loss of informal coordination and a single interpreter of the situation	Chronic delays and managerial inertia
Operating	Formally correct, but ineffective solutions	Replacing contextual analysis with regulatory compliance	The growth of solutions that do not solve systemic problems
Organizational	Growing interfunctional conflicts	The disappearance of the subject who smoothed out contradictions between departments	Institutionalization of conflicts
Organizational	Fragmentation of responsibility	Distribution of functions without assigning integral responsibility	Loss of control while formally maintaining the structure

Personnel	Outflow of key specialists	Decreased predictability and trust in governance	Weakening of the management and expert core
Personnel	Demotivation of middle management	Increased responsibility without expansion of authority	Burnout and loss of initiative
Reputational	Declining internal managerial legitimacy	Conflicting management signals	Persistent distrust of management decisions
Reputational	Weakening the external image of the organization	Instability of management processes	Loss of partnership and personnel opportunities
Psychosocial	Conflict-related burnout of the management core	A long stay in a zone of unresolved contradictions	Consolidation of managerial dysfunction
Systemic	Self-reproduction of the management crisis	Personalization of failures instead of structural correction	Prolonged management collapse

In the context of managerial displacement, the key risk for a strong leader is not so much the loss of a formal managerial position, but rather the retention of implicit responsibility for the state of the management system after the end of their tenure. This configuration creates an asymmetry between responsibility and power and creates the conditions for the retrospective personalization of systemic failures. Therefore, managerial exit requires consideration not as a personnel event, but as an independent management process subject to institutionalization.

The proposed model of strategic management exit is based on the need to complete the management cycle in a way that clearly defines the boundaries of managerial responsibility and limits the interpretive scope of the management narrative to documented facts. This is not about maintaining one's position at any cost, but rather about preserving managerial agency and professional reputation in the face of changing institutional status.

The first element of the model is the establishment of the time and scope of managerial responsibility. The manager must institutionally define the termination date of his or her authority and the scope of the completed managerial functions. This step allows for a clear timeline of managerial influence and prevents subsequent attribution of responsibility for decisions and events occurring outside of his or her managerial control.

The second element is the closure of management cycles. Unlike a formal transfer of a position, a strategic exit involves taking stock of decisions made, ongoing processes, and identified management risks. Recording the status of management tasks allows for the discussion of consequences to shift from the personal level to the level of the system's management states, thereby reducing the likelihood of retrospective, accusatory interpretations [18,19].

The third element of the model is the transfer of not only management "tasks" but also the management framework. In digital organizations, a significant portion of management resilience is ensured not by formal regulations, but by connections, dependencies, and informal coordination mechanisms. Their explication during the exit process—through the description of risks, cross-functional dependencies, and decision-making logic—promotes the institutionalization of previously

informal management nodes and reduces the likelihood of systemic disruption after the departure of the leader.

The fourth element is the decomposition of responsibility. The model assumes a clear distribution of management zones between the outgoing manager and the new management entities, with the corresponding boundaries defined. This helps restore the balance between authority and responsibility and avoid the institutional vacuum characteristic of an asymmetrical management exit.

The fifth element is limiting the informal continuation of the managerial role. In the practice of managerial displacement, the manager often maintains actual participation in decision-making in a consultative format, which reproduces an asymmetry of responsibility. Strategic exit involves formalizing such interactions and restricting them, preventing the return of implicit managerial agency without appropriate authority.

Taken together, the proposed model of strategic management exit allows us to view the departure of a strong leader not as a loss of managerial resources, but as a controlled institutional process. For the leader, it protects their professional reputation and prevents the retrospective personalization of systemic failures. For the organization, it reduces the risk of management domino effects and creates the conditions for more sustainable reproduction of management functions in a digitalized environment.

In situations of managerial displacement, the consequences are determined not only by the fact of the manager's departure but also by how this departure is explained within the organization . The way management changes are interpreted shapes employees' attitudes toward the event and directly influences the future sustainability of management. This is why the management narrative—that is, the official and unofficial explanation of the reasons for the management transition—becomes an important element of management dynamics.

If the management narrative isn't fixed and structured, the organization is open to arbitrary interpretations. In this case, a decline in performance or an increase in management failures after the departure of a strong leader is often attributed to their "legacy" or past mistakes, even if the real cause is the breakdown of the established coordination system. Thus, systemic problems are replaced by personal assessments, which hinders their accurate analysis.

This problem is especially acute in digital organizations. Formalized control systems and performance indicators reflect results, but do not demonstrate why they were achieved . After management displacement, digital data captures deviations, but they are interpreted simplistically—as confirmation of the ineffectiveness of the previous management, rather than as a consequence of changes in the management structure.

Therefore, a strategic management exit requires consciously documenting the management explanation for the changes taking place . This isn't about defending a personal position, but rather about clarifying the logic of the management transition: what decisions were made previously, what state the processes are in at the time of exit, and who is responsible for their further development. Such documentation reduces the risk of distorted interpretations and helps maintain the connection between management decisions and their actual consequences.

An equally important element is the clear assignment of responsibility. In the practice of managerial displacement, a situation often arises in which authority has already been transferred to new management bodies, but responsibility for results remains implicitly associated with the departing manager. This creates managerial uncertainty and complicates the restoration of control.

Viewing managerial displacement as a systemic phenomenon has important implications for the development of HR architecture and crisis management practices in organizations, especially in the context of digitalization. In traditional HR thinking, leadership replacement is often viewed as a personnel decision, limited by performance assessments, compliance with competencies, or strategic guidelines. However, an analysis of the managerial domino effect shows that this approach fails to identify and prevent systemic risks associated with the loss of managerial coherence.

For HR architecture, this means shifting the focus from assessing a manager's formal performance indicators to analyzing their systemic role in management. A strong manager performs

not only the functions outlined in job descriptions but also informal coordination tasks that ensure the sustainability of management processes. Ignoring this aspect leads to HR decisions that appear formally justified, but actually undermine the organization's manageability.

Considering the phenomenon of managerial displacement and the managerial domino effect expands the scope of HR. It allows us to view management changes not as isolated personnel events, but as elements of a management architecture, the correctness of which determines the organization's resilience in the face of digital management. This creates the basis for a transition from formally rational but risky decisions to more sustainable management models that consider both the formal and subjective aspects of management activity, (Table 4).

Table 4 - Strategic elements of management output and their systemic effects

Analytical measurement	Content of management action	What systemic problem does it solve?	Risk in the absence of action
Boundary of management responsibility	Recording the moment of termination of powers and the scope of completed management functions	Prevents retrospective attribution of responsibility	Personalization of system failures after the manager's exit
Completion of management cycles	Formalization of the status of decisions, processes and identified risks	Translation of consequences into the plane of management states	Shaping the Narrative of "Unfinished Management"
Transfer of control circuit	Explication of dependencies, coordination links and decision logic	Reducing the loss of management coherence	Destruction of informal governance nodes
Institutional distribution of responsibility	Delineation of responsibility for past, current and future decisions	Restoring the balance between authority and responsibility	Institutional vacuum of governance
Management narrative	Recording the logic of the management transition and the reasons for the changes	Limiting arbitrary interpretations	Legitimization of retroactive displacement
Post-weekend participation format	Regulation of consultative interaction without the return of powers	Preventing implicit reproduction of responsibility	Asymmetric management exit
Anti-crisis management effect	Reducing the likelihood of cascading management failures	Localization of the management domino effect	Prolonged loss of control
Implications for HR architecture	Taking into account the systemic role of the manager in personnel decisions	Improving the quality of HR audits	Formally rational, but risky personnel decisions

The study allowed us to examine the managerial displacement of a strong leader not as an isolated personnel incident, but as a systemic management phenomenon capable of triggering the collapse of organizational stability in the context of digital and formalized management. The removal of a leader serving as a systemic management hub sets off a nonlinear chain of consequences that are not captured by standard management control tools and therefore remain undetected in the early stages. The key finding of the study is the substantiation of the management domino effect as a specific form of cascading management failures arising from the dismantling of informal management nodes. This effect manifests itself in a decrease in the consistency of management decisions, fragmentation of responsibility, increased conflict, and the development of conflict-related burnout within the management core. Unlike linear models of management risk, the domino effect is prolonged and nonlinear, necessitating a revision of traditional approaches to assessing the consequences of management decisions [1, 2]. The study's findings serve as a warning for organizations focused on digitally rational management. Ignoring the subjective dimension of management's role and underestimating informal management nodes creates conditions in which formally sound management decisions lead to systemic failures and loss of control. Understanding the domino effect of management allows us to move from reactive management of consequences to proactive design of sustainable management architectures in the context of digital transformation.

LITERATURE

1. Power, M. The Audit Society: Rituals of Verification. Oxford: Oxford University Press, 1997.
2. Zuboff, S. The Age of Surveillance Capitalism. New York: PublicAffairs, 2019.
3. Mintzberg, H. The Nature of Managerial Work . New York: Harper & Row, 1973.
4. Mintzberg, H. Managing. San Francisco: Berrett -Koehler, 2009.
5. Weick, KE Sensemaking in Organizations. Thousand Oaks, CA: Sage Publications, 1995.
6. Weick, KE, Sutcliffe, KM Managing the Unexpected: Sustained Performance in a Complex World. Hoboken: Wiley, 2015.
7. Scott, WR Institutions and Organizations: Ideas, Interests, and Identities. Thousand Oaks, CA: Sage Publications, 2014.
8. Luhmann, N. Organization and Decision. Cambridge: Cambridge University Press, 2018.
9. Hood, C. The Blame Game: Spin, Bureaucracy, and Self-Preservation in Government . Princeton: Princeton University Press, 2011.
10. Reason, J. Managing the Risks of Organizational Accidents. Aldershot: Ashgate, 1997.
11. Perrow, C. Normal Accidents: Living with High-Risk Technologies. Princeton: Princeton University Press, 1999.
12. Ulrich, D. HR from the Outside In. New York: McGraw-Hill, 2012.
13. Boudreau, JW, Ramstad, PM Beyond HR: The New Science of Human Capital. Boston: Harvard Business School Press, 2007.
14. Taleb, NN Antifragile: Things That Gain from Disorder. New York: Random House, 2012.
15. Taleb, NN The Black Swan: The Impact of the Highly Improbable. New York: Random House, 2007.
16. Maslach, C., Leiter, M.P. The Truth About Burnout . San Francisco: Jossey -Bass, 1997.
17. Kahn, W.A. Psychological Conditions of Personal Engagement and Disengagement at Work // Academy of Management Journal. 1990. Vol. 33(4).
18. Edmondson, A. The Fearless Organization . Hoboken: Wiley, 2018.
19. Schein, E.H. Organizational Culture and Leadership. Hoboken: Wiley, 2017.

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РАЗРАБОТКА МЕТОДИКИ АВТОМАТИЗИРОВАННОГО АНАЛИЗА И ПОДДЕРЖКИ РАССЛЕДОВАНИЯ КИБЕРАТАК С ПРИМЕНЕНИЕМ МЕТОДОВ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА

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Аннотация. *В современных цифровых системах кибератаки приобретают всё большую сложность, масштаб и скорость распространения. Традиционные методы расследования инцидентов безопасности часто оказываются недостаточно эффективными из-за огромных объемов данных и высокой изменчивости угроз. В связи с этим возрастает роль методов искусственного интеллекта (ИИ) в автоматизации анализа, обнаружения и поддержки расследований кибератак. Данная статья предлагает методическую основу для внедрения ИИ-подходов в процессы автоматизированной аналитики киберугроз и исследования инцидентов. Анализ преимуществ и ограничений ИИ-методов показал необходимость гибридных решений и обеспечения объяснимости моделей в судебно-экспертной практике.*

Ключевые слова*: методика, кибератака, автоматизированный анализ, искусственный интеллект.*

Развитие цифровых технологий привело к экспоненциальному росту числа и разнообразия кибератак, которые могут нанести существенный ущерб организациям и инфраструктуре. Для проведения эффективных расследований необходимо не только выявление фактов атаки, но и глубокий анализ последовательности событий, методов злоумышленников и возможных векторов проникновения. Традиционные средства анализа логов и инцидентов часто не справляются с большими объемами данных, а человеческий фактор становится узким местом при расследовании сложных инцидентов в масштабах корпоративной сети. Использование ИИ позволяет автоматизировать рутинные аналитические задачи, а также выстраивать модели, способные выявлять скрытые закономерности и предсказывать возможные шаги атакующих, что существенно ускоряет процесс реагирования и повышает качество принимаемых решений. Для реализации таких подходов необходимо опираться на теоретические основы, включая цифровую форензику и методы ИИ.

Цифровая форензика — это дисциплина, включающая сбор, хранение, анализ и представление цифровых доказательств при расследовании инцидентов. Интеграция ИИ в цифровую форензику позволяет автоматизировать этапы обработки данных и повысить точность выявления аномальных событий, уменьшив нагрузку на экспертов[1].

Среди наиболее используемых методов ИИ в кибербезопасности: машинное обучение (ML) — для классификации событий, выявления аномалий и прогнозирования угроз [2]; глубокое обучение (DL) — особенно эффективно для анализа сложных паттернов в сетевом трафике [3]; обработка естественного языка (NLP) — для анализа текстов журналов событий, отчётов и угроз [4,5]. Применение нейросетевых моделей позволяет повысить эффективность обнаружения сетевых атак и выявления сложных аномалий в потоках данных [6,7]. На основе этих теоретических основ предлагается методика, включающая следующие этапы: сбор данных, предобработка данных, обнаружение аномалий, классификация инцндентов, анализ

временных зависимостей, корреляция событий, интеллектуальная интерпретация, поддержка реагирования.

Интеллектуальный анализ в рамках автоматизированного расследования кибератак основан на применении совокупности моделей искусственного интеллекта, каждая из которых решает специализированные аналитические задачи. Использование ансамбля моделей позволяет повысить точность обнаружения атак, сократить количество ложных срабатываний и обеспечить поддержку принятия решений экспертами по информационной безопасности. Особое внимание в интеллектуальном анализе уделяется следующим моделям ИИ.

1. Модели классификации. Назначение: Определение типа кибератаки или нормального поведения системы на основе размеченных данных. Применяемые модели: Random Forest ,Support Vector Machine (SVM), Logistic Regression Gradient Boosting (XGBoost, LightGBM) Используются для: классификации сетевого трафика (DDoS, Brute Force, SQL-инъекции); определения вредоносных и легитимных событий; автоматического тегирования инцидентов в SIEM-системах. Преимущество: высокая интерпретируемость и устойчивость к шуму данных, что важно для судебной экспертизы.

2. Модели обнаружения аномалий. Назначение: Выявление неизвестных или ранее не зафиксированных атак без предварительной разметки данных. Применяемые модели: Isolation Forest, One-Class SVM, DBSCAN, K-Means, Autoencoder (AE). Используются для: обнаружения нетипичного сетевого поведения; выявления инсайдерских угроз; фиксации отклонений в системных логах и пользовательской активности. Преимущество: способность выявлять zero-day-атаки и скрытые угрозы.

3. Глубокие нейросетевые модели. Назначение: Анализ сложных, высокоразмерных и временных данных. Применяемые модели: CNN (Convolutional Neural Networks) — анализ сетевых пакетов и бинарных файлов; LSTM / GRU — анализ временных рядов событий и логов; Transformer-модели — корреляция сложных последовательностей атак. Используются для: выявления многошаговых атак (APT); анализа временной динамики вторжений; прогнозирования дальнейших действий злоумышленника. Преимущество: высокая точность при анализе сложных атакующих сценариев.

4. Графовые модели и анализ связей. Назначение: Выявление причинно-следственных связей между событиями и субъектами атаки. Применяемые модели: Graph Neural Networks (GNN), Markov Chains, Bayesian Networks. Используются для: реконструкции цепочки атаки; выявления ключевых узлов компрометации; анализа lateral movement внутри сети. Преимущество: визуализация атак как сценариев, а не отдельных событий.

5. Модели обработки естественного языка. Назначение: Интеллектуальный анализ неструктурированных текстовых данных. Применяемые модели: BERT, RoBERTa, TF-IDF + ML-классификаторы, Named Entity Recognition (NER). Используются для: анализа логов и отчетов инцидентов; автоматического извлечения индикаторов компрометации (IoC); сопоставления инцидентов с базами угроз (MITRE ATT&CK). Преимущество: сокращение времени анализа документации и отчетности.

6. Обучение с подкреплением. Назначение: Оптимизация стратегий реагирования на кибератаки. Применяемые модели: Q-Learning, Deep Q-Networks (DQN), Policy Gradient Methods. Используются для: выбора оптимальных мер реагирования; автоматического блокирования атак; адаптации системы к изменяющимся угрозам. Преимущество: самообучение и адаптация в реальном времени.

7. Объяснимый искусственный интеллект. Назначение: Обеспечение прозрачности и юридической обоснованности решений ИИ. Применяемые методы: SHAP, LIME, Rule-based explanations. Используются для: объяснения причин классификации инцидента; формирования экспертных заключений; повышения доверия к автоматизированной системе. Преимущество: соответствие требованиям цифровой форензики и судебной экспертизы.

Интеллектуальный анализ в автоматизированных системах расследования кибератак строится на комплексном использовании классификационных, аномалийных, нейросетевых,

графовых и объяснимых моделей ИИ. Такой подход обеспечивает не только высокую точность выявления угроз, но и поддержку экспертов на всех этапах расследования — от первичного обнаружения до формирования доказательной базы.

Автоматизированная система может использовать гибридные подходы, сочетая несколько алгоритмов для повышения качества обнаружения сложных мультишаговых атак.

Предлагается следующая архитектурная схема: Источник данных → Система агрегации → Предобработка → Модуль ИИ (ML/DL) → Аналитическая панель → Экспертное заключение и отчётность.

Такой подход обеспечивает непрерывный цикл анализа и поддержки принятия решений. В рамках модуля ИИ возможна реализация моделей обучения с подкреплением, которые адаптируются к новым типам угроз на лету.

Преимущества: повышение скорости обработки огромных массивов данных; возможность выявления сложных паттернов и аномалий; автоматизация рутинных задач эксперта. Ограничения: большие требования к качеству данных; необходимость объяснимых моделей (Explainable AI) для юридической достоверности; высокие вычислительные ресурсы для обучения и поддержки. Конкретная привязка моделей ИИ к этапам методики автоматизированного расследования кибератак, представлена в таблице 1.

Таблица1- привязка моделей искусственного интеллекта к этапам методики автоматизированного расследования кибератак

Этап методики	Задачи этапа	Применяемые модели ИИ	Результат
1. Сбор данных	Агрегация логов, сетевого трафика, телеметрии безопасности	NLP-модели (TF-IDF, BERT), Rule-based фильтрация	Структурированные данные для анализа
2.Предобработка данных	Очистка, нормализация, устранение шумов	Autoencoder, PCA, K-Means	Подготовленные признаки для обучения
3.Обнаружение аномалий	Выявление нетипичных событий и отклонений	Isolation Forest, One-Class SVM, Autoencoder	Список подозрительных инцидентов
4.Классификация инцидентов	Определение типа атаки	Random Forest, SVM, XGBoost	Классифицированные инциденты
5.Анализ временных зависимостей	Выявление многошаговых атак	LSTM, GRU, Transformer	Сценарии атак (APT)
6.Корреляция событий	Поиск причинно-следственных связей	Graph Neural Networks, Bayesian Networks	Реконструированная цепочка атаки
7. Интеллектуальная интерпретация	Поддержка эксперта, формирование выводов	XAI (SHAP, LIME), Rule-based модели	Объяснимые результаты анализа
8.Поддержка реагирования	Выбор оптимальных мер защиты	Reinforcement Learning (DQN, Q-Learning)	Оптимизированные меры реагирования

Таблица 1 демонстрирует, что методика не опирается на одну модель, а реализует гибридный интеллектуальный контур, где каждый этап расследования поддерживается специализированными алгоритмами ИИ.

Научная новизна исследования заключается в разработке комплексной методики автоматизированного анализа и поддержки расследования кибератак, основанной на интеграции методов искусственного интеллекта и цифровой форензики. Основные элементы научной новизны: предложен многоуровневый интеллектуальный подход к расследованию кибератак, объединяющий методы классификации, обнаружения аномалий, анализа временных рядов и графового анализа в рамках единой методики; обосновано применение гибридных моделей ИИ, сочетающих машинное обучение, глубокие нейронные сети и методы объяснимого искусственного интеллекта для повышения достоверности и интерпретируемости результатов расследования; впервые в рамках предлагаемой методики показана возможность использования обучения с подкреплением для интеллектуальной поддержки принятия решений при реагировании на кибератаки. Разработан механизм объяснимости выводов интеллектуального анализа, позволяющий использовать результаты автоматизированного расследования в экспертной и судебной практике. На основе этой новизны можно утверждать о том, что предложенная методика открывает новые возможности, опираясь на работы [1-7].

Интеграция методов искусственного интеллекта в процессы анализа и расследования кибератак представляет собой перспективное направление развития цифровой форензики. Предложенная методика автоматизированного анализа позволяет повысить эффективность выявления угроз и сократить время реакции. Однако успех применения ИИ требует комплексного подхода к архитектуре систем, качеству данных и объяснимости выводов моделей.

ЛИТЕРАТУРА

1. Ragho R.R., Chaudhari N. Artificial Intelligence in Digital Forensics: A Review of Cyber-Attack Detection Models and Frameworks. Journal of Information Systems Engineering and Management (2025).
2. И. В. Котенко, Д. А. Левшун. Методы интеллектуального анализа системных событий для обнаружения многошаговых кибератак. Искусственный интеллект и принятие решений (2023).
3. A. Djenna et al. Unmasking Cybercrime with AI-Driven Cybersecurity Analytics. Sensors (Basel) (2023).
4. Ahmed Zaki. Automated Cyber Threat Intelligence Analysis Using AI and Natural Language Processing in Enterprise Networks. Journal of Artificial Intelligence for Data-Driven Discovery (2025).
5. S. Yusupova. The Role of Artificial Intelligence in the Investigation of Cybercrimes. International Journal of Artificial Intelligence (2025).
6. Ж. Алимсеитова, Г. Бекетова. Анализ нейросетевых моделей и методов обнаружения сетевых атак. Вестник КазАТК (2022).
7. Г. Аблизова. Искусственный интеллект в кибербезопасности: роль машинного обучения в обеспечении защиты данных. Innovations in Science and Technologies (2025).

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JOB DESCRIPTION IN THE DIGITAL AGE: THE INSTITUTIONAL GAP BETWEEN FUNCTIONAL DYNAMICS, RESPONSIBILITIES, AND COMPENSATION

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Abstract: *This article examines the transformation of job descriptions in the digital economy. It demonstrates that digitalization is leading to accelerated changes in the content of work, while formal labor regulations are updated much more slowly. As a result, an institutional gap is emerging between the actual functions of employees, their assigned responsibilities, and the remuneration system. It has been substantiated that the expansion of tasks related to the use of ERP systems, analytical tools, and digital platforms is not reflected in HR documents, which creates management, legal, and motivational risks: a decrease in the transparency of expectations, an increase in hidden professional tension, and a weakening of trust in the HR system. Suggested areas for modernizing job descriptions include transitioning to an adaptive job description model, integration with performance appraisal and compensation systems, and regular review of functionality within the digital HR architecture. The findings can be used to improve organizations' HR practices in the context of digital transformation.*

Key words*: job description, digitalization of labor, labor function, institutional gap, remuneration, HR management, personnel management. institutional gap, remuneration, HR digitalization, personnel management*

In the context of digital transformation of organizations, qualitative changes are occurring in the content of work, the structure of work functions, and the methods of organizing personnel activities [1,2]. The introduction of digital platforms, ERP systems, automated management tools, analytical modules, and HR information systems leads to the fact that the employee's work function is becoming more dynamic, multi-component, and changeable compared to the industrial management model [3-5].

At the same time, the basic regulatory framework for labor relations—job descriptions, remuneration regulations, and qualification requirements—in most organizations retain a logic of stability and infrequent revision. These documents continue to be developed as static job descriptions, focused on a relatively unchanging set of responsibilities [6]. As a result, a structural mismatch arises between the actual content of work and its formal description [7].

In practice, this discrepancy manifests itself in the expansion of employee responsibilities without revising job descriptions, employment contracts, and compensation systems. New tasks related to digital systems, performance monitoring, analytics, process support, and platform interaction are gradually incorporated into employees' daily activities as a "natural development" of their position. However, these changes are often not legally or economically recorded [8,9].

Thus, job descriptions are increasingly ceasing to function as a relevant management tool and are used primarily as a formal document required to comply with regulatory requirements. They do

not capture the actual state of the job function, but rather an outdated model that fails to account for the speed and direction of digital change.

This problem is particularly significant for HR departments and organizational leaders, as the misalignment between functions, obligations, and compensation creates persistent management risks. These include decreased transparency of expectations, increased hidden professional tension, weakened trust in the HR management system, and increased potential for conflict in labor relations [10].

It's important to emphasize that this isn't a matter of isolated management errors or unfair practices, but rather a systemic effect of digitalization, where traditional HR tools are failing to adapt to changing job descriptions. Under these circumstances, it's necessary to rethink the role of job descriptions as an element of an organization's HR architecture.

In the classical management system, job descriptions served as one of the fundamental tools for the institutionalization of labor. Their primary purpose was to establish a stable set of job functions, define the boundaries of employee responsibility, and provide a formal link between the work performed, qualification requirements, and the compensation system. In this logic, job descriptions were viewed not as an auxiliary document, but as a supporting element of the organization's managerial and legal framework [7-9].

The development of job descriptions took place in conditions of relative stability in business processes and slow technological change. Employee functions were typically predetermined, rarely revised, and maintained for long periods. Changes in job descriptions were episodic and typically accompanied by formal documentation updates, staffing adjustments, and revisions to remuneration conditions [11].

Within this model, the job description served several key functions. First, it provided legal clarity for the job function, mitigating the risk of blurred expectations and arbitrary expansion of responsibilities [12]. Second, it served as a management guide for managers, allowing them to assign tasks and evaluate performance within pre-established frameworks. Third, the job description served as the basis for constructing a compensation system, as the level of pay was directly related to the scope and complexity of the assigned functions.

It's important to note that within the industrial management logic, there was a relative synchronicity between three elements: actual work activity, formally defined responsibilities, and the compensation system [13]. A disruption to this balance was viewed as an aberration requiring managerial or legal action. This is why job descriptions were perceived as "rigid" documents, changes to which required coordinated decisions and formal procedures.

The classic job description was designed for a predictable organizational environment, where work had clear boundaries and change occurred slowly and in a controlled manner. This model worked effectively in the industrial economy, but proved vulnerable in the context of accelerated digital transformation, when work became dynamic, multitasking, and difficult to describe statically.

Digitalization has significantly changed not only management tools but also the very nature of the work function [2]. Unlike the industrial model, where work was structured around relatively stable operations and processes, the digital environment is characterized by rapid change, the constant expansion of tasks, and the redistribution of roles between people and systems. Under these conditions, the work function ceases to be fixed and acquires a dynamic, adaptive nature.

The implementation of digital platforms, ERP systems, and automated accounting, analytics, and control modules is leading to employees being assigned new responsibilities not previously included in their job descriptions [3,4]. This may include working with digital reports, monitoring performance indicators, maintaining information systems, interacting with algorithms and platforms, and performing internal control and process coordination functions. Such changes are typically not formalized as job title changes, but are perceived as a "natural evolution" of their functions.

A key feature of digital change is its continuous nature. Functions are expanded and modified not as a result of one-time management decisions, but through constant adaptation to updates to

systems, regulations, and digital tools. As a result, the content of work can change significantly over a short period of time, while the job description remains unchanged for several years [14].

The result of this dynamic is a gap between actual functionality and formally assigned responsibilities. Employees begin to perform an expanded range of tasks, extending beyond their job description, while maintaining the same level of formal obligations and compensation. The lack of documentation of changes creates the illusion of stability, while the actual workload and responsibility increase [7,8].

It's important to emphasize that the acceleration of functional change is driven not by individual employee initiatives or subjective management decisions, but by the objective logic of digitalization. Digital systems require constant human involvement in configuration, monitoring, data interpretation, and decision-making, leading to a gradual shift in job boundaries without a formal review of their content.

Digitalization is creating a new management reality in which traditional tools for describing work prove disproportionate to the pace and scale of change.

The acceleration of functional change in the digital environment is leading to a persistent disconnect between the actual content of work, formal employee obligations, and the compensation system. This disconnect is not episodic but systemic and is a direct consequence of the inadequacy of traditional HR tools to keep pace with digital transformation.

In practical organizations, this manifests itself in the expansion of employee responsibilities without formally revising job descriptions and employment contracts. New tasks related to digital processes, automated systems, reporting, and control are gradually incorporated into daily work, but are not reflected in the documents defining the scope of duties and levels of responsibility. Meanwhile, the compensation system continues to rely on the original job description, which no longer corresponds to the actual workload.

As a result, the basic principle of proportionality between work and remuneration is violated. Employees perform a greater range of functions and bear increased responsibility without receiving formal recognition of these changes in the form of a review of pay or status [15]. This situation creates a sense of injustice and undermines trust in the HR management system, even in the absence of any intention on the part of the employer to worsen working conditions [16].

A characteristic of the digital age is that this misalignment often remains unnoticed at the formal level. Documented, the job function remains unchanged, reducing the likelihood of management or legal action. However, at the level of actual performance and the subjective perceptions of employees, the gap between expectations and rewards accumulates and, over time, becomes a source of internal tension and conflict.

It's important to note that the problem isn't limited to isolated cases of overload or management errors. It reflects a deeper institutional shift, in which digitalization is changing the content of work faster than the mechanisms for formalizing and compensating it are being updated. Under these conditions, job descriptions lose their function as a balance of interests and become a formal attribute that fails to provide real regulation of labor relations.

The misalignment between job functions, responsibilities, and compensation is becoming one of the key challenges for HR systems in the digital age. Ignoring this misalignment increases management risks, reduces the sustainability of HR processes, and requires a revision of approaches to describing and assessing job functions in modern organizations [6,13-15].

In digital organizations, job descriptions are increasingly losing their original purpose as tools for truly regulating work functions and are gradually being transformed into formal documents used primarily to comply with regulatory and legal requirements. While retaining their external structure and mandatory details, their content increasingly reflects the actual activities of employees [11,17].

One of the key reasons for this transformation is the mismatch between the static nature of job descriptions and the dynamics of digital processes. In a context where employee roles change regularly and often without a clear end point, formally updating the description becomes managerially costly and organizationally complex. As a result, organizations prefer to maintain the document

unchanged, compensating for discrepancies between the text and actual work through informal management decisions.

In practice, job descriptions begin to function as "insurance documents" designed to minimize legal risks rather than reflect actual job functions. They are used as the basis for formally assigning positions, conducting inspections, undergoing audits, and resolving disputes, while the actual distribution of tasks occurs outside the scope of this document.

This situation creates a managerial duality. On the one hand, there is a formally approved job model, documented. On the other hand, the actual work model is formed within the operational management framework and is constantly changing under the influence of digital tools and requirements. The gap between these models reduces the transparency of management expectations and complicates the assessment of work performance.

For HR, this situation means the loss of a key management tool. Job descriptions cease to be the reference point for assessing workload, establishing competency requirements, and justifying changes to the compensation system. As a result, personnel decisions become increasingly dependent on subjective assessments and informal agreements, increasing the risk of conflict and reducing the predictability of HR practices.

In the digital world, job descriptions increasingly function as a formal element of HR documentation, failing to adequately reflect job functions. This circumstance requires a rethinking of their role and the search for new approaches to documenting and managing employee responsibilities in the context of accelerated digitalization.

A discrepancy between formal job descriptions and actual workloads creates not only management risks but also significant legal and compensation risks for organizations. In the context of digitalization, these risks become systemic, as the expansion of employee responsibilities occurs gradually and often without formally documenting changes to working conditions.

From a legal perspective, a job description remains one of the key documents used to assess an employee's scope of duties, responsibilities, and suitability for the position. In the event of labor disputes, it is often considered the starting point for determining the permissible boundaries of a job function. If there is a significant discrepancy between the text of the job description and actual performance, the employer's position becomes vulnerable, since the employee's performance of additional functions is not documented [18].

Compensation risks arise when the actual expansion of functions is not accompanied by an adequate review of the compensation system. Additional responsibilities are incorporated into current activities without changing salary, allowances, or other compensation components. Over the long term, this leads to the accumulation of hidden liabilities on the part of the employer and the formation of claims by employees, which can be realized through both negotiations and legal proceedings [15].

A particularly challenging situation arises when digital functions become critical to process stability but are not formally defined. Employees bear increased responsibility for the results of digital operations, reporting, and control, without corresponding status or compensation. In the event of failures or errors, this creates uncertainty in the distribution of responsibility and increases legal risks for all parties in the employment relationship.

For HR, this misalignment complicates the justification of management decisions related to compensation reviews, KPI implementation, and performance assessment. The lack of an up-to-date, documented description of functions reduces the transparency of compensation policies and hinders the development of fair and repeatable HR practices.

The discrepancy between job descriptions and the actual functions of employees in the digital environment creates a complex set of legal and compensation risks. Ignoring these risks increases the likelihood of labor disputes, reduces the sustainability of the HR system, and requires a transition to more adaptive approaches to the formalization and evaluation of job functions [8,16-18].

The discrepancy between formally defined job descriptions and the actual content of work has a direct impact on employee motivation and the sustainability of HR systems overall. In a digital

environment, this effect is amplified by the high transparency of processes, constant monitoring of performance indicators, and rising expectations for work results.

When an employee systematically performs functions not reflected in their job description and not compensated for in the compensation system, a sense of disparity develops between their contribution and their reward. Meanwhile, working conditions may remain outwardly unchanged, making it difficult to openly discuss the issue and allowing it to remain latent. Motivational tension builds gradually and rarely manifests as outright conflicts in the early stages.

Over the long term, this situation leads to decreased engagement and increased hidden resistance [16,19,20]. Employees begin to limit their initiative, avoid additional tasks, and perceive digital innovations as a source of unpaid workload. As a result, digital tools, initially implemented to improve efficiency, begin to be perceived as a factor of pressure and control, rather than a means of supporting work.

For the HR system, this means a loss of predictability in employee behavior. Formally loyal employees may experience decreased productivity, increased turnover, or passive performance. However, the causes of these processes are difficult to diagnose, as documents and regulations do not record the actual expansion of functions.

This problem is particularly significant for management and expert personnel, whose work in the digital environment is most susceptible to functional blurring. The lack of formal recognition of additional roles diminishes the value of professional expertise and undermines trust in the organization's HR policies.

Misalignment between job descriptions and actual work content is becoming a factor that undermines the motivation and sustainability of HR systems. Preventing these effects requires a shift from formal controls to more flexible and transparent mechanisms for defining responsibilities, expectations, and compensation in the context of digital transformation.

Today's digital transformation demands a rethinking of approaches to formalizing job functions. Traditional job descriptions, focused on a fixed list of responsibilities and infrequent reviews, are ineffective in an environment where employee responsibilities change regularly and often without a clear end point. These conditions necessitate a transition from static documents to a more flexible, adaptive model for describing job functions.

The adaptive model eliminates detailed and exhaustive lists of operations in favor of functional blocks and areas of responsibility. This approach allows for the identification of areas of activity, expected results, and levels of responsibility rather than specific actions, making the document more resilient to changes in digital processes. Functionality updates are accomplished through adjustments to individual blocks or applications rather than a complete rewrite of the manual.

A key element of the adaptive model is the regular review of job descriptions. Unlike traditional practices, where job descriptions may not be updated for years, the adaptive approach involves a planned assessment of changes related to the implementation of digital tools, process automation, and task redistribution. Such reviews can be integrated into annual HR cycles or performance appraisal procedures.

It's important to note that the transition to an adaptive model does not mean a loss of legal certainty. On the contrary, it allows for a more precise recording of the actual content of work and reduces the risk of informal expansion of responsibilities. For HR, this creates the basis for more informed decisions regarding compensation, competency assessment, and workload management [3,11]. An adaptive job description model is seen as a response to the challenges of digital work dynamics. It allows for maintaining manageability and transparency in labor relations while simultaneously providing the necessary flexibility in the face of constant functional change.

One of the key areas of transformation of job descriptions in the digital age is their integration with performance appraisal systems and compensation mechanisms. In the traditional model, these elements often exist separately: the job description defines responsibilities, the KPI system evaluates results, and compensation is determined based on the staffing schedule and local regulations. In the

context of accelerated digitalization, this disconnect exacerbates the disconnect between actual work and compensation [13].

In a digital environment, an employee's job description directly impacts performance indicators, scope of responsibility, and work intensity. However, without an updated job description, the evaluation system begins to rely on metrics not formally defined in the employee's job description. This creates a situation in which the employee is held accountable for achieving results not reflected in their official job description, undermining the transparency and fairness of the evaluation.

Integrating job descriptions with the performance appraisal system requires clearly defining the relationship between functional units, expected results, and performance indicators. In this case, KPIs and other metrics act not as external control tools but as a logical extension of the defined functions. This approach reduces the risk of subjective assessment and improves the repeatability of management decisions.

The connection with the compensation system is no less important. Expanded functionality, especially in terms of digital tasks and responsibilities, should be reflected in the compensation model. An updated job description can serve as the basis for differentiating salaries, establishing allowances, and revising bonuses. This allows for the formalization of changes in working conditions and reduces the likelihood of conflicts and complaints from employees.

For companies, integrating these elements creates a more robust HR management architecture. Job descriptions cease to be isolated documents and become part of a unified system linking functions, assessments, and compensation. In the context of digital transformation, this approach is essential for maintaining trust, motivation, and the manageability of HR processes.

In the context of digital transformation, a one-time review of job descriptions is no longer an effective management decision. The rapid pace of change in business processes, digital platforms, and regulations means that even updated documents quickly become outdated. Under these circumstances, regular review of job descriptions is no longer an additional HR procedure, but a necessary element of an organization's digital HR architecture.

Regular reviews involve systematically recording changes in job descriptions resulting from the implementation of digital tools, process automation, and task redistribution. Unlike ad hoc adjustments, this approach is based on a pre-established update cycle synchronized with key HR processes—performance assessment, compensation planning, competency management, and organizational change.

The practical value of regular reviews lies in the ability to promptly identify functional shifts and prevent the accumulation of an institutional gap between actual work and its formal description. This avoids situations in which expanded responsibilities are perceived as an informal norm and are not documented or compensated for.

For the company, this mechanism creates a tool for control and transparency. Functional changes are recorded as they occur, rather than post-factum , simplifying the justification for salary revisions, KPI changes, and adjustments to competency requirements. Furthermore, regular reviews reduce the dependence of personnel decisions on subjective assessments and improve the reproducibility of HR practices.

Regular functional reviews should be considered a structural element of the digital HR architecture, ensuring the adaptability of job descriptions and the sustainability of the HR management system. In the context of accelerated digitalization, this approach is becoming a key factor in maintaining a balance between efficiency, fairness, and legal certainty in employment relationships.

In the context of digital transformation, HR is becoming a key player, capable of identifying and compensating for the institutional gap between employees' actual performance, formal obligations, and the compensation system. Unlike line managers, whose focus is on operational results, HR has the ability to comprehensively analyze workloads, personnel documents, and compensation mechanisms.

HR's role in this situation goes beyond traditional administration and compliance monitoring. It involves developing a holistic labor management architecture in which job descriptions, performance appraisal systems, and compensation are considered interrelated elements. This approach allows not only to identify the impact of digital change but also to manage it at an early stage.

The practical task of the HR department is to create procedures that ensure regular updating of functions and their formal consolidation. This involves implementing mechanisms for monitoring changes in job descriptions, formalizing digital roles, and HR's involvement in digitalization projects at the design stage rather than after the fact. In this case, the expansion of functions is accompanied by a timely review of responsibilities and compensation.

Furthermore, HR plays a key role in fostering transparent communication with employees. Explaining the rationale behind changes, documenting them, and linking them to the compensation system help mitigate motivational risks and prevent the growth of hidden resistance. This is especially important in an environment where digital tools are perceived by employees as a factor of additional control and workload.

In the digital era, HR functions are not simply the custodian of HR regulations, but the architect of a sustainable labor management system. The effectiveness of digital transformations and the long-term stability of an organization's HR system largely depend on their ability to promptly identify and address institutional gaps.

Modernizing job descriptions in the context of digitalization requires a shift from formal document updates to a systemic review of approaches to job descriptions. The primary goal is not to increase the length of job descriptions, but to enhance their practical value and align them with the actual content of work.

First and foremost, it's advisable to avoid excessively detailed operations, which quickly become irrelevant as digital tools change. Instead, job descriptions should be structured around functional blocks that reflect key areas of responsibility, typical tasks, and expected results. This format ensures document stability and reduces the need for constant revision.

An important element of modernization is the inclusion of provisions in job descriptions that allow for the adaptation of functions in the context of digital changes. This allows for the legitimate redistribution of tasks without compromising legal certainty and reduces the risk of informal expansion of responsibilities. At the same time, any significant changes must be accompanied by a formal assessment of their impact on the employee's workload and responsibilities.

Particular attention should be paid to linking updated job descriptions with the performance appraisal and compensation system. The expansion of digital functions should be reflected in the compensation model, whether through salary revisions, the introduction of allowances, or adjustments to bonuses. This connection ensures the principle of proportionality between work and compensation and increases trust in HR practices.

Furthermore, modernizing job descriptions requires the active participation of line managers and HR specialists. Collaborating on analyzing actual functions and documenting them reduces the risk of a formal approach and facilitates the development of uniform management standards.

The practical modernization of job descriptions in a digital organization should focus on adaptability, transparency, and integration with key HR processes. Implementing these approaches allows job descriptions to transform from formal regulations into an effective HR management tool in a digitally dynamic environment.

Despite the obvious advantages of adaptive job description models, their implementation in digital organizations is fraught with a number of limitations and risks that require a conscious management approach. Ignoring these factors can lead to the formalization of new models and the loss of their practical value.

One of the key risks is the substitution of adaptability for vague job descriptions. Without sufficient clarity, functional blocks can be interpreted too broadly, creating the preconditions for an

uncontrolled expansion of responsibilities. In this case, the adaptive model loses its protective function for the employee and increases the asymmetry of interests in the employment relationship.

The level of management maturity of an organization also poses a significant limitation. Adaptive job descriptions require developed HR processes, transparent evaluation mechanisms, and a strong culture of managerial accountability. In organizations with fragmented management systems, there is a risk of flexible job descriptions being used as a tool of pressure or to circumvent pay review procedures.

The legal aspect deserves special attention. In a context of insufficient regulation, adaptive models can be perceived as weakening formal guarantees, increasing the likelihood of labor disputes and complicating the defense of employers' positions. This requires a careful balance between flexibility and legal certainty, as well as the involvement of legal services in the development of new job description formats.

An additional risk is the increased administrative burden on HR. Regularly reviewing functionality, monitoring digital changes, and coordinating stakeholders require resources and clearly defined procedures. Without these, the adaptive model can degenerate into a formal process without any real managerial impact.

Implementing adaptive job description models requires not only methodological development but also the organization's readiness to embrace change at the process, cultural, and accountability levels. Understanding these limitations helps minimize risks and ensure the sustainability of new approaches to labor management in the digital age, (Table 1).

Table 1 - Management guidelines for HR management when transforming job descriptions

Management zone	Focus of HR Department Actions	What does this give to the organization?	Risk of no action
Recording of functional changes	Monitoring actual expansion of functions	Early detection of overloads and imbalances	Hidden growth of responsibilities without recognition
Updating job descriptions	Transition from rare to scheduled revision	Reducing the institutional gap	Formalization of outdated labor models
Link to performance evaluation	Synchronization of functionality and KPIs	Increasing the fairness of assessment	Responsibility for “other people’s” indicators
Compensation policy	Analyzing the impact of digital features on payment	Proportionality of work and reward	Accumulation of compensation claims
Legal stability	Collaboration between HR and lawyers	Reducing the risk of labor disputes	Vulnerability of the employer's position
Communication with staff	Transparent explanation of changes	Decrease in latent resistance	Lack of trust in digital initiatives
Participation in digital projects	Including HR at the design stage	Managed transformation of labor	Shifting risks to workers

HR system diagnostics	Analysis of the document-reality gap	Improving the maturity of HR architecture	Late detection of systemic problems

In the digital age, job descriptions are no longer simply HR documents and are taking on a deeper function: they serve as indicators of an organization's ability to maintain a balance between an employee's actual workload, level of responsibility, and compensation system. Essentially, job descriptions become a negotiating point for the interests of all parties. If they reflect actual responsibilities and are aligned with the performance appraisal and compensation systems, the organization demonstrates management maturity and the ability to consciously address the consequences of digitalization. However, if job descriptions are merely formal and reflect an outdated work model, this indicates a hidden redistribution of workload and responsibility without due recognition.

The key idea is that the problem of job descriptions in the digital age is not a problem of the document per se. It's a problem of management choice: either an organization recognizes that digitalization is changing the content of work and requires a revision of institutional mechanisms, or it uses formal tools to mask the growing gap between expectations and compensation.

In this sense, job descriptions serve a diagnostic function. They help identify where digital change is being driven by responsible management and where it's being passed on to employees. The greater the discrepancy between the job description and actual activity, the greater the risk of latent conflicts accumulating, trust declining, and the loss of stability in the HR system.

In the digital age, job descriptions should be viewed not as secondary regulations, but as an element of management ethics and economic justice. Their relevance and meaningfulness become an indicator of the organization's readiness to recognize the real work of its employees and build long-term, sustainable labor relations in an environment of constant change.

In a digital organization, the state of job descriptions can be considered an early indicator of the overall quality and maturity of the HR system. Unlike formal performance indicators or reporting metrics, job descriptions reflect not stated intentions, but rather the actual management approach to recognizing employee performance, responsibility, and contribution.

If job descriptions are regularly updated, reflect real areas of responsibility, and are linked to the performance appraisal and compensation system, this demonstrates the HR system's ability to adapt to changes and manage their consequences. In such organizations, digitalization is accompanied by a conscious redefinition of roles, transparent communication, and the institutionalization of new functions.

The opposite situation—the formal retention of outdated job descriptions while actually expanding functionality—indicates the initial signs of HR system degradation. At this stage, digital changes are used primarily to increase demands on employees without adequately reconsidering obligations and compensation. The system may appear stable on the surface, but structural contradictions are building up internally.

The unique feature of this indicator is its leading nature. Discrepancies between job descriptions and actual performance emerge long before increased turnover, open conflicts, or a decline in engagement rates. Therefore, analyzing job descriptions allows for early identification of risks, when management intervention is still possible without significant losses.

This creates a diagnostic tool for the enterprise that doesn't require complex measurements or additional costs. Comparing formal functionality with actual employee activity allows us to assess the extent to which digital transformation is supported by institutional accountability or, conversely, is masking the redistribution of workload at the expense of personnel.

The core problem with job descriptions in the digital age comes down not to their form or length, but to the choice of managerial position. Organizations focused on formal compliance inevitably face the accumulation of hidden risks. Organizations that embrace responsibility for digital

labor gain the opportunity to build more equitable, sustainable, and effective labor relations in an environment of constant change (Table 2).

Table 2 - Job description as an indicator of maturity and fairness of the HR system

Analysis criterion	Formally stable model	Managerially mature model
Relevance of functionality	Fixes an outdated job description	Reflects actual areas of responsibility
Attitude to digital tasks	Considered as "additional"	Institutionally recognized as part of labor
Connection with wages	Payment is based on historical functionality	Remuneration is related to actual contribution
The Role of a Job Description	Legal cover	Management balance tool
Transparency of expectations	Expectations are set informally	Expectations are set and reproducible
Behavioral response of workers	Hidden resistance, burnout	Conscious engagement
HR position	Document compliance control	Responsibility for the architecture of work
Long-term effect	Accumulation of latent conflicts	Sustainability of the HR system

In the context of digital transformation, it's becoming clear that the traditional job description is no longer capable of fully regulating labor relations. However, the problem lies not in the document's outdated format, but in a deeper mismatch between the logic of modern labor and the traditional notion of an employment contract as a fixed set of responsibilities and compensation.

This article proposes considering the job description as an element of a broader construct— a dynamic, functional contract between the employee and the organization. This contract is understood not as a separate legal document, but as a set of formalized and managerial agreements that define the current balance between functions performed, level of responsibility, and compensation in the context of a constantly changing digital workforce.

The key feature of a dynamic functional contract is its recognition of the variability of the work function as the norm, not an aberration. Unlike the traditional approach, which perceives changes in functionality as temporary or exceptional, this concept recognizes that in a digital organization, work is inherently evolving. Consequently, the contract between employee and employer must be adaptable without losing control and legal certainty.

In this logic, the job description ceases to be an exhaustive job description and functions as an anchor, establishing a basic level of obligations and responsibilities. All changes arising from digitalization are built on this anchor and are subject to regular assessment for their impact on workload, risks, and the value of work. Thus, the organization assumes responsibility not for the immutability of functions, but for the transparency and proportionality of their changes.

The novelty of the proposed concept lies in its shift in emphasis from formal document compliance to the manageability of the process of labor change itself. A dynamic functional contract allows for the institutionalization of digital flexibility without turning it into a tool for unilateral

workload redistribution. It creates the basis for a conscious dialogue between the employee and the organization about the boundaries of responsibility, expectations, and compensation.

It's important to emphasize that this concept doesn't contradict current legal models of labor relations, but rather complements them with a managerial dimension. It allows job descriptions to be integrated into a broader HR architecture, where changes in functionality are considered a management objective rather than an informal practice.

The Dynamic Functional Contract is an attempt to conceptually rethink the role of job descriptions in the digital age—not as static regulations, but as part of a living, adaptable agreement on work, responsibility, and reward. An empirical illustration of the institutional gap in the context of digitalization of labor. Example (case). The evolution of specialist functionality in the context of digitalization of HR processes.

At one large organization implementing digital transformation projects in the area of HR management and compensation calculation, a typical situation was observed in which a labor function was expanded without appropriate institutionalization.

Initially, the specialist held a position focused on payroll calculation and administration. This role involved ensuring the accuracy of payroll calculations, compliance with regulations, and interaction with accounting systems. As part of the organization's digital initiatives, the specialist was additionally involved in the implementation of electronic document management, testing digital solutions, and participating in the development of new regulations.

At the initial stage, expanded functionality was considered a project-based burden and was accompanied by additional compensation. This helped maintain a balance between increased responsibility and economic recognition of additional contributions. However, as digital processes stabilized, the new functions were integrated into the specialist's daily work and were no longer viewed as temporary or project-based.

As a result, additional functionality was transformed into a mandatory part of the job description without a formal revision of the job description or compensation system. The original job description remained unchanged, only outlining the initial scope of responsibilities. The specialist's actual role became hybrid, combining operational, analytical, and project-based functions.

This situation was not the result of management intent or an individual decision, but rather reflected the typical logic of digitalization, in which new functions are gradually "normalized" and no longer perceived as grounds for reconsidering working conditions. Similar processes were observed in other departments involved in digital projects, indicating the systemic nature of the phenomenon.

The example discussed illustrates the article's key thesis about the formation of an institutional gap between actual functionality, formally established obligations, and the compensation system. It also confirms the need to move from the formal compliance of personnel documents to a managed model of digital labor recognition based on the principles of a dynamic functional contract.

To ensure that the concept of a dynamic functional contract does not remain a theoretical construct, it must be translated into manageable and replicable HR processes. The key challenge at this stage is to institutionalize the variability of the labor function without eroding legal certainty and managerial discipline.

The operationalization of a dynamic functional contract involves dividing the labor function into two levels. The first level is the basic functional outline, set out in the job description and reflecting the core of the position, its purpose, and minimum scope of responsibility. This outline maintains relative stability and provides the legal basis for the employment relationship.

The second level is formed as a variable functional layer, incorporating tasks and roles arising from digitalization, project-based activities, the implementation of new systems, and changes to business processes. This layer does not require constant rewriting of job descriptions, but is subject to regular recording and evaluation as part of HR procedures. Thus, functional variability becomes manageable rather than hidden.

Practical implementation of this approach is possible through the introduction of periodic functional reviews, synchronized with performance appraisal or compensation planning cycles. These reviews analyze not only task performance but also the evolution of the job function, including the emergence of new areas of responsibility and digital roles. The review results are used as the basis for adjusting KPIs, revising compensation, or formalizing changes through supplementary agreements.

a special role in operationalizing the concept, serving as a coordinator between line managers, legal departments, and employees. HR's role is to ensure the transparency of changes and prevent their one-sided interpretation. In this context, the dynamic functional contract becomes a tool for management dialogue rather than unilateral control.

It's important to emphasize that the proposed model doesn't require a radical overhaul of existing HR systems. It can be implemented evolutionarily, through tweaking existing assessment procedures, updating local regulations, and changing the management logic for handling job descriptions. This makes the concept applicable to organizations with varying levels of digital maturity.

The operationalization of a dynamic functional contract allows the problem of misalignment between work, responsibility, and compensation to be shifted from an informal realm to a manageable one. In the context of digital transformation, this approach creates the foundation for more equitable, transparent, and sustainable labor relations without disrupting the organization's institutional framework.

The implementation of a dynamic functional contract has not only methodological but also practical managerial value, especially in the context of rapid digital change. Its key advantage is that it allows organizations to shift from reactive management of the consequences of digitalization to proactive management of the process of work change itself.

From a management perspective, a dynamic functional contract creates a mechanism for the early detection of functional overloads and imbalances. Since changes in the work function are recorded and discussed regularly, the organization is able to promptly adjust task assignments, reallocate responsibilities, and make informed decisions on salary revisions. This reduces the likelihood of hidden risks accumulating and reduces reliance on crisis-driven decisions.

For middle and senior managers, this approach increases the transparency of management expectations. A clear distinction between the basic functional framework and the variable layer allows for the formulation of realistic performance expectations and reduces the risk of an implicit expansion of responsibilities. As a result, management decisions become more reproducible and less dependent on subjective interpretations of the employee's role.

From the HR perspective, a dynamic functional contract simplifies the integration of digital changes into the HR architecture. It creates a unified logical framework in which job descriptions, performance appraisal systems, training, and compensation are considered elements of a single management cycle. This allows HR policies to be built around the actual evolution of work, rather than isolated documents.

This approach is particularly valuable in the context of organizational resilience. Recognizing the variability of work functions and institutionalizing it reduces uncertainty for employees and increases trust in management decisions. In the context of digital transformation, this becomes an important factor in maintaining employee engagement and preventing latent burnout.

A dynamic functional contract can be viewed as a next-generation management tool, enabling organizations to combine the flexibility of the digital economy with the necessary level of formalization and accountability. Its use contributes to the development of a more mature labor management model, in which digital change ceases to be a source of latent conflict and becomes a manageable factor in development, (Table 3).

Table 3 - Architecture of a dynamic functional contract in a digital organization

Model element	Semantic role	What is recorded	Management effect
Basic functional outline	Institutional support of the labor function	Core duties, job description, minimum level of responsibility	Legal certainty, protection from arbitrary expansion of obligations
Variable Functional Layer	Digital Adaptation Zone	Additional roles, digital tasks, project functions	Managed flexibility without job destruction
Regular review mechanism	Update tool	Recording changes in functionality over time	Preventing accumulation of latent load
Link to performance evaluation	Channel of institutional recognition of labor	Reflection of new features in KPIs and results	Reducing the subjectivity of assessment
Compensatory response	Economic recognition of changes	Pay adjustments, allowances, bonus bases	Maintaining the principle of proportionality between work and remuneration
HR coordination	Management control of model integrity	Synchronization of documents, assessments and compensation	Reducing systemic HR risks
Communication circuit	Social sustainability of the model	Transparency of changes for the employee	Increased trust and decreased latent resistance
Diagnostic function	Management maturity indicator	The degree of correspondence between formal and actual work	Early detection of HR system degradation

The analysis conducted in this article demonstrates that the problem of job descriptions in the digital age extends far beyond HR document flow. In the context of accelerated digitalization, the content of work changes faster than the formal mechanisms for regulating it are updated, leading to a persistent misalignment between employees' actual functions, their assigned obligations, and the compensation system.

Job descriptions, while remaining a key element of labor relations, are increasingly losing their regulatory function and are used primarily as a formal legal document. This creates managerial, legal, and motivational risks that accumulate gradually and often go unnoticed until conflicts arise, engagement declines, or the HR system becomes unstable [14,20].

The article argues that this misalignment is systemic and is caused not by the errors of individual managers or employees, but by the institutional limitations of traditional HR tools in the digital environment. Attempts to address the problem through targeted document adjustments are insufficient without reconsidering the very logic of formalizing the labor function.

As a conceptual response, the idea of a dynamic functional contract is proposed, which views job descriptions as elements of a broader management structure. This approach allows for the institutionalization of variability in work, maintaining legal certainty, and ensuring proportionality between the functions performed, the level of responsibility, and compensation.

The practical significance of the proposed concept lies in the possibility of its phased implementation without radically overhauling existing HR systems. The use of a dynamic functional contract creates conditions for more transparent management of digital change, increased employee trust, and strengthened resilience of the organization's HR architecture.

Rethinking the role of job descriptions in the digital age is not a technical challenge, but a strategic management choice. Organizations that recognize and formalize the real content of work gain a competitive advantage in the form of more sustainable, equitable, and adaptive labor relations in a constantly changing environment.

LITERATURE

1. Armstrong M. Human Resource Management Practice. — St. Petersburg: Piter, 2020.
2. Becker G. Human Capital: Investments in Education and Vocational Training. Moscow: HSE Publishing House, 2018.
3. Brooking E. Intellectual capital. — St. Petersburg: Piter, 2019.
4. Davenport T., Harris J. Analytics as a competitive advantage. - M.: Alpina Publisher, 2018.
5. Drucker P. F. Effective Leader. - M.: Mann, Ivanov and Ferber, 2021.
6. Kaplan R., Norton D. Balanced Scorecard. - M.: Olimp-Business, 2019.
7. Kotter J. Ahead of Change. - M.: Alpina Publisher, 2020.
8. Mintzberg G. Structure in a Fist: Creating an Effective Organization. — St. Petersburg: Piter, 2017.
9. OECD. The Future of Work: OECD Employment Outlook. — Paris: OECD Publishing, 2019.
10. Schwab K. The Fourth Industrial Revolution. — Geneva: World Economic Forum, 2016.
11. World Economic Forum. Jobs of Tomorrow: Mapping Opportunity in the New Economy. — Geneva, 2020.
12. Ulrich D. Human Resource Champions. — Boston: Harvard Business School Press, 1997.
13. Ulrich D., Brockbank W. HR Competencies for the Next Generation. - Alexandria: SHRM Foundation, 2018.
14. Boxall P., Purcell J. Strategy and Human Resource Management. — London: Palgrave Macmillan, 2016.
15. International Labor Organization. Work for a Brighter Future: Global Commission on the Future of Work. — Geneva, 2019.
16. Cascio W., Boudreau J. Investing in People: Financial Impact of Human Resource Initiatives. - Upper Saddle River: FT Press, 2011.
17. Lawler E. Talent: Making People Their Competitive Advantage. — San Francisco: Jossey -Bass, 2008.
18. Labor Code of the Republic of Kazakhstan (current version).
19. ISO 30414:2018 Human resource management — Guidelines for internal and external human capital reporting.
20. ISO 9001:2015 Quality management systems — Requirements (in terms of process management and responsibility).

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VISUALIZATION OF THE DEVELOPMENT OF A METHODOLOGY FOR AUTOMATED ANALYSIS AND SUPPORT OF CYBERATTACK INVESTIGATIONS USING ARTIFICIAL INTELLIGENCE METHODS WITH VOSVIEWER

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Abstract. *The article presents the development and visualization of a methodology for automated analysis and investigation support of cyberattacks based on artificial intelligence techniques. The relevance of the study is determined by the rapid growth of complex multi-stage cyber incidents, where traditional expert-based analysis of event logs, network traffic, and digital traces becomes inefficient and time-consuming. The aim of the research is to design a conceptual methodology for intelligent support of cyberattack investigations using data mining algorithms and scientific visualization tools. The methodological framework includes machine learning, data mining, clustering, and semantic analysis methods, as well as the VOSviewer software for constructing relationship maps between attack features, events, and behavioral patterns of adversaries. The scientific novelty lies in combining artificial intelligence methods with bibliometric and graph-based visualization in VOSviewer for cyber incident analysis. The practical significance is associated with reducing investigation time, improving attack attribution accuracy, and supporting decision-making for information security and digital forensics specialists.*

Keywords: *cybersecurity, cyberattack, digital forensics, artificial intelligence, machine learning, data mining, VOSviewer, data visualization, indicators of compromise.*

The rapid growth of cyber threats has increased the need for intelligent and automated approaches to support cyberattack investigations. This study focuses on the visualization of the development of a methodology for automated analysis and investigative support using artificial intelligence techniques. The objective is to explore research trends, key concepts, and relationships within the scientific literature by applying VOSviewer for bibliometric mapping and network visualization. Through the analysis of selected academic publications, dominant keywords and thematic clusters are identified to provide a structured overview of the evolution and current directions of AI-driven cyberattack investigation methodologies [1].

We exported metadata from 64,557 publications from the Web of Science (WoS) database using the following query: "TITLE: ("cyberattack investigation" OR "cyberattack investigations" OR "automated analysis" OR "AI methods" OR "artificial intelligence" OR "cybersecurity support" OR "investigation methodology" OR "cybersecurity investigation"), timespan: 2020–2025. Indexes: SCI - EXPANDED, SSCI, CPCI - S, ESCI. The construction of a network of co-occurrence of keywords and their clustering was carried out using the VOSviewer 1.6.15 program [2].

The minimum occurrence of keywords selected for consideration was four. The total number of keywords in the 64,557 publications considered (Authors and Keywords Plus generated by WoS) is 2,203. The number of keywords that appear at least 4 times is 110, and further analysis was carried out on them.

During the analysis, the spellings of keywords were not translated into Russian in order to preserve their original meanings. To reduce the number of clusters into which keywords (KW) are aggregated, an additional restriction has been introduced: at least 100 KW per cluster.

Table 1 presents the visualization of the development of a methodology for the automated analysis and support of cyberattack investigations using artificial intelligence methods. The visualization, created with VOSviewer, illustrates the structure of the research field by mapping key concepts, keyword co-occurrences, and thematic clusters related to cyberattack detection, digital forensics, and intelligent investigative support systems. It highlights the relationships between emerging technologies, analytical approaches, and methodological frameworks, enabling a clearer understanding of research trends, collaboration patterns, and the evolution of AI-driven solutions for improving the efficiency, accuracy, and scalability of cyberattack investigation processes.

Table 1- 40 most frequently occurring keywords in a sample of 64,557 metadata

Keyword	**N-kw**	**Keyword**	**N-kw**	**Keyword**	**N-kw**	**Keyword**	**N - kw**
artificial intelligence	295	future	18	design	13	diabetic-retinopathy	10
machine learning	119	deep	17	risk	13	cardiology	9
deep learning	81	big data	17	machine	13	convolutional neural-network	8
classification	43	images	16	disease	12	identification	8
prediction	40	system	16	ultrasound	11	trust	8
diagnosis	29	neural-networks	16	health	11	decision-making	8
ethics	21	algorithm	15	computer-aided detection	11	radiomics	7
technology	21	neural-network	15	impact	10	computer-aided diagnosis	6
validation	19	performance	14	accurace	10	coronary-artery-disease	6

model	18	segmentation	13	framework	10	medicine	6

Notes: keyword is the name of the term; N-kw is the occurrence of the term.

The dominant keywords are related to the topic, its artificial intelligence, machine learning, deep learning, classification, prediction, diagnosis, ethics, technology, validation, model, future, deep, big data, images, system, neural-networks, algorithm, neural-network, performance, and segmentation.

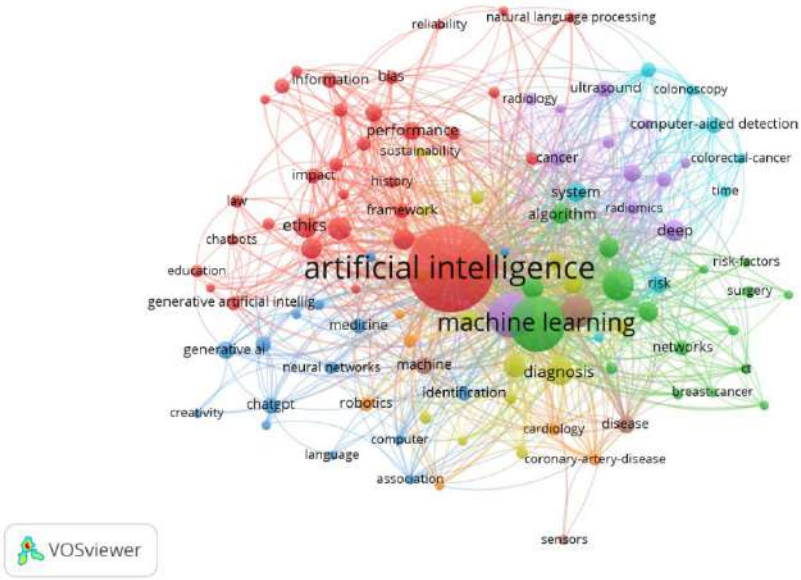

Figure 1- Keyword Co-Occurrence Network Visualization: 110 Most Frequent Terms in 64,557 Publications

If we consider separately the keywords of the authors themselves, then with a total number of 1,284 KW, 42 KW occur at least four times, while the total number of keywords plus (Keywords Plus) generated by the WoS platform is 1,046 and those encountered more than four times are 70.

Table 2 - Comparison of the 30 most common keywords used by publication authors and WoS platform keywords

Author Keywords	N-kw	Keywords Plus	N-kw
artificial intelligence	295	explainability	7
machine learning	119	medical imaging	6
deep learning	81	algorithms	6
ai	25	imaging	6
ethics	15	radiology	5

generative ai	13	radiomics	5
large language models	9	natural language processing	5
artificial intelligence (ai)	9	algorithm	5
big data	8	cardiology	5
generative artificial intelligence	8	chatbots	5
chatgpt	8	prediction	5
robotics	7	fairness	5
neural networks	7	healthcare	4
diagnosis	7	automation	4
ultrasound	7	cardiovascular disease	4

The table 2 presents the result of a comparison of the 30 most common keywords of publication authors and keywords of the WoS platform. It shows that authors often use more general terms to classify their publications: artificial intelligence, machine learning, deep learning, ai, ethics, generative ai, large language models, artificial intelligence (ai), big data, generative artificial intelligence, chatgpt, robotics, neural networks, diagnosis, and ultrasound.

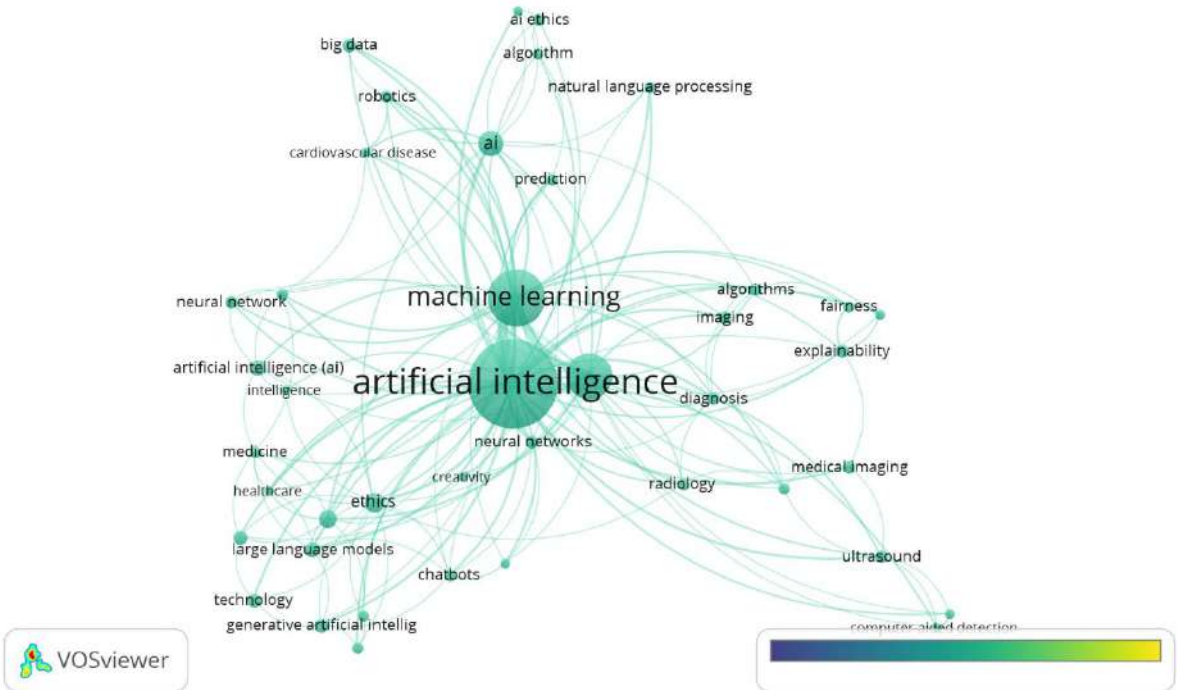

Figure 2- Overlay Visualization of 30 Most Common Keywords: Author-Assigned vs. WoS-Generated Terms

The Web of Science (WoS) platform also generates a list of "Keywords Plus" based on the analysis of the full texts of publications. These terms often describe the topic from a broader perspective than the authors' original keywords. In this case, the dominant terms include: classification, prediction, diagnosis, images, validation, neural-network, system, performance, model, ai, neural-networks, future, risk, deep, machine, disease, segmentation, algorithm, diabetic-retinopathy, and technology which collectively provide a deeper insight into the implementation of the themes addressed by the authors' keywords [3].

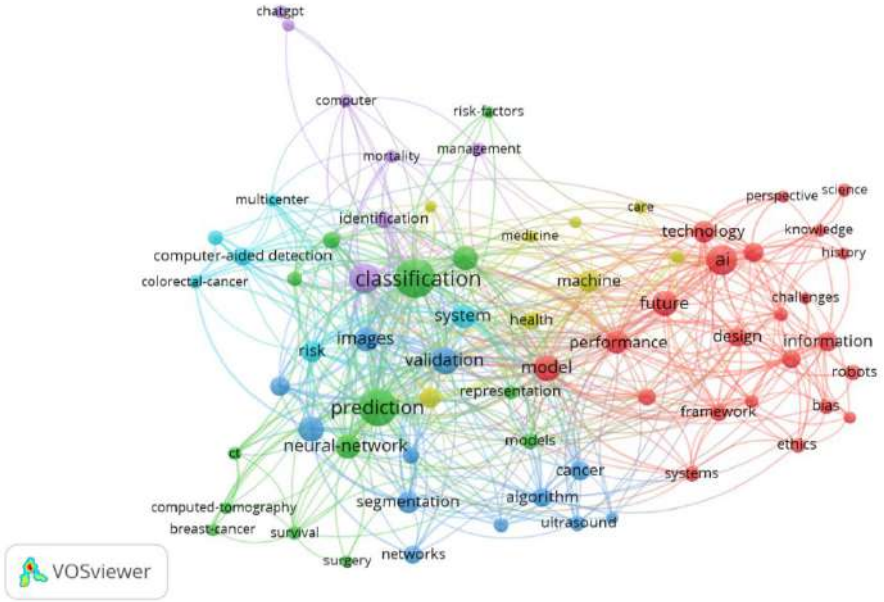

Figure 3- Keywords Plus Co-Occurrence Network Visualization: 70 Most Frequent in 64,557 Publications

This is also reflected in the clustering of author keywords, WoS platform keywords and the sum of these keywords. Clustering is based on the co-occurrence of keywords in a publication; the clustering algorithm is described in detail in the VOSviewer 1.6.15 user manual. Identification of the dominant keywords in each cluster allows us to reduce bias in the further collection of scientific publications on a narrower issue, for example, to compile a systematic review. A well-known problem of narrow specialists: they see their topic well, overestimate the importance of key terms close to them and tend to underestimate other people's topics. At the same time, a significant part of innovations is implemented at the intersection of research areas.

This study presents an in-depth analytical review of the scientific development of methodologies for automated analysis and support of cyberattack investigations using artificial intelligence techniques, based on large-scale bibliometric data and visualization tools [4]. The rapid escalation of cyber threats, combined with the increasing complexity and volume of digital evidence, has made traditional manual investigation methods insufficient. As a result, artificial intelligence has emerged as a critical enabler for automating investigative processes, improving analytical accuracy, and supporting decision-making in cybersecurity operations [5].

Using the VOSviewer software environment, this research visualizes the intellectual structure and thematic evolution of AI-driven cyberattack investigation studies by mapping keyword co-occurrence networks and identifying dominant research clusters. The visualization reveals that artificial intelligence, machine learning, and deep learning form the conceptual core of the research field, closely interconnected with applied domains such as digital forensics, intrusion detection, threat intelligence, and automated incident response [6]. These interconnections highlight a shift from

isolated analytical tools toward integrated investigative frameworks capable of processing heterogeneous cybersecurity data sources.

The clustering results demonstrate that contemporary research increasingly focuses on predictive modeling, classification algorithms, and neural network architectures to support cyberattack detection and investigation. At the same time, methodological clusters related to explainability, validation, and ethical AI reflect growing concern over transparency, accountability, and trustworthiness in automated cybersecurity systems [7]. This trend indicates a maturation of the field, where performance optimization is complemented by an emphasis on responsible and reliable AI deployment in high-risk security environments.

Moreover, the analysis identifies the growing influence of big data analytics and natural language processing techniques in cyberattack investigations. These methods enable the automated analysis of logs, network traffic, reports, and unstructured textual evidence, significantly enhancing the scalability and efficiency of investigative workflows [8]. The bibliometric visualization also illustrates the interdisciplinary nature of the field, combining knowledge from computer science, cybersecurity engineering, data science, and digital forensics. Such interdisciplinary integration fosters innovation at the intersection of analytical theory and practical investigation needs [9].

The results of this visualization-based analysis provide a structured overview of research trends and conceptual relationships, which can support the formulation of future research agendas and the development of systematic literature reviews on specific aspects of AI-assisted cyberattack investigation [10]. By reducing terminological bias and revealing underexplored connections between research themes, the study contributes to a deeper understanding of how artificial intelligence technologies can be systematically integrated into cyberattack investigation methodologies. Overall, the findings confirm the strategic importance of AI-driven automation and visualization tools in advancing efficient, accurate, and scalable investigative support systems for modern cybersecurity challenges.

REFERENCES

1. Chen, H., Chiang, R.H.L., & Storey, V.C. (2012). Business Intelligence and Analytics: From Big Data to Big Impact. MIS Quarterly, 36(4), 1165–1188.
2. VOSviewer Manual: Van Eck, N. J., & Waltman, L. (2021). VOSviewer Manual: Version 1.6.15. Centre for Science and Technology Studies, Leiden University.
3. Chen, C. (2006). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. Journal of the American Society for Information Science and Technology, 57(3), 359–377.
4. Songül Karakuş & Sevinç Ay (2025). Bibliometric Analysis of Publication in the Field of Artificial Intelligence and Cyber Security. Balkan Journal of Electrical and Computer Engineering, 13(3), 355–366. https://doi.org/10.17694/bajece.1585201.
5. Brundage, M., et al. (2018). The malicious use of artificial intelligence: Forecasting, prevention, and mitigation. arXiv preprint arXiv:1802.07228.
6. Sommer, R., & Paxson, V. (2010). Outside the closed world: On using machine learning for network intrusion detection. IEEE Symposium on Security and Privacy, 305–316.
7. Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. Nature Machine Intelligence, 1(9), 389–399.
8. Buczak, A. L., & Guven, E. (2016). A survey of data mining and machine learning methods for cyber security intrusion detection. IEEE Communications Surveys & Tutorials, 18(2), 1153–1176.
9. Casey, E. (2011). Digital evidence and computer crime: Forensic science, computers, and the Internet. Academic Press.
10. Kitchenham, B., & Charters, S. (2007). Guidelines for performing systematic literature reviews in software engineering. EBSE Technical Report.

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ИННОВАЦИИ В БАНКОВСКОМ ОБСЛУЖИВАНИИ ЮРИДИЧЕСКИХ ЛИЦ: ЦИФРОВОЕ КРЕДИТОВАНИЕ И ЭКВАЙРИНГ

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Аннотация. *Статья рассматривает современные инновации в банковском обслуживании юридических лиц, уделяя особое внимание цифровому кредитованию и эквайрингу. На основе анализа практики Народного банка Казахстана за 2024–2025 гг. оценивается экономический эффект от внедрения этих технологий, проводится SWOT-анализ, приводятся кейсы клиентов и даются рекомендации по дальнейшему развитию цифровых сервисов. Статья предназначена для специалистов в области корпоративного банкинга и исследователей цифровых финансовых технологий.*

Ключевые слова: *цифровое кредитование, эквайринг, корпоративный банкинг, Народный банк Казахстана, цифровизация, экономический эффект, аналитика.*

В условиях растущей конкуренции на финансовом рынке Казахстана и мира банки активно внедряют цифровые технологии для оптимизации обслуживания юридических лиц [1; 2]. Ускорение бизнес-процессов, развитие e-commerce и повышение требований к скорости и надежности услуг делают цифровое кредитование и эквайринг ключевыми инструментами для компаний, позволяющими оперативно управлять финансами, а для банков — повышать доходность и эффективность операций [1].

Особое внимание в Казахстане уделяется малому и среднему бизнесу (МСБ), для которого оперативное кредитование и прием безналичных платежей имеют критическое значение [2]. Внедрение онлайн-заявок, AI-скоринга и мобильных эквайринговых решений значительно сокращает временные издержки и повышает удовлетворенность клиентов [1; 2]. Юридические лица ожидают от банков: быстрых и прозрачных кредитов; удобного эквайринга; интеграции с ERP-системами и мобильным банкингом; аналитических инструментов для управления финансовыми потоками. Цифровизация не только снижает операционные расходы, но и повышает прозрачность транзакций, ускоряя принятие решений для бизнеса [1].

Далее в статье мы подробно рассмотрим цифровое кредитование как основу для оперативного финансирования, а затем перейдем к эквайрингу как инструменту безналичных расчетов. Анализ будет подкреплен данными из практики Народного банка Казахстана, экономическими расчетами и прогнозами.

Цифровое кредитование юридических лиц в Казахстане развивается быстрыми темпами [2]. Наиболее востребованы продукты, обеспечивающие скорость получения кредита и минимизацию бюрократических процедур. Банки предлагают разнообразные инструменты: онлайн-овердрафт, кредитные линии для МСБ, инвестиционные кредиты и продукты с AI-скорингом [1; 2]. Эти решения позволяют юридическим лицам оперативно планировать оборотный капитал и реализовывать как краткосрочные, так и долгосрочные проекты (таблица 1).

Таблица 1 - Виды кредитов и условия

Вид кредита	Особенности	Лимит / срок	Ставка
Овердрафт онлайн	Быстрое решение, онлайн-заявка	До 50 млн тг / до 12 мес	1,2 %/мес (14,4 % годовых)
Кредитная линия для МСБ	Дистанционное оформление	До 100 млн тг / до 24 мес	1,1 %/мес (13,2 % годовых)
Инвестиционный кредит	Долгосрочные проекты	До 500 млн тг / до 60 мес	12–14 % годовых
Специальные продукты для МСБ	Минимум документов, AI-скоринг	До 30 млн тг / до 12 мес	1,0–1,3 %/мес (12–15,6 % годовых)

В Таблице 1 наиболее активно растет сегмент кредитов для МСБ с использованием AI-скоринга. Это объясняется тем, что предприниматели ценят скорость одобрения и минимизацию требований к документам [2]. Для банка такие кредиты позволяют снизить затраты на обработку заявок и ускорить возврат средств [1].

Для иллюстрации экономической выгоды рассмотрим расчет аннуитетных платежей по формуле: $P=K\times r\times(1+r)n(1+r)n-1$ где: **P** — размер ежемесячного платежа (аннуитета); **K** — сумма кредита (тело кредита, начальная сумма)**r** — месячная процентная ставка (в долях, например, 1,2% = 0,012); **n** — количество месяцев (срок кредита). Пример расчета: кредит 10 млн тенге, ставка 1,2 %/мес, срок 12 месяцев → ежемесячный платеж ≈ 895 000 тг. Полученная сумма платежа позволяет клиенту заранее планировать денежные потоки. Благодаря цифровому каналу подачи заявки клиент получает не только мгновенный предварительный расчет графика платежей, но и решение по кредиту за несколько часов вместо нескольких дней при традиционном подходе. Такая скорость существенно повышает удовлетворенность клиентов, улучшает управление денежными потоками и укрепляет конкурентные позиции банка.

Анализ практики Народного банка Казахстана показывает стабильный рост кредитного портфеля, особенно в сегменте МСБ с цифровыми продуктами [3]. Это связано с быстрым внедрением онлайн-заявок и скоринга(таблица 2).

Таблица 2 - Кредитный портфель юридических лиц 2024–2025 (млрд тг)

Вид кредита	2024 г.	2025 г.	Рост, %
Овердрафт онлайн	4,2	4,6	9,5
Кредитная линия МСБ	3,1	3,5	12,9
Инвестиционный кредит	8,5	8,9	4,7
Специальные продукты МСБ	2,0	2,3	15,0
Итого	17,8	19,3	8,4

Ожидается, что внедрение и дальнейшее совершенствование цифровых инструментов кредитования продолжит положительно влиять на динамику портфеля. Прогноз на 2026–2027 гг.: ежегодный рост кредитного портфеля юридических лиц на уровне 8–12 %; наибольшая динамика в сегменте МСБ благодаря AI-скорингу и ускоренной цифровой подаче заявок; среднее время рассмотрения заявки сократится с 1–2 дней до нескольких часов; доля полностью онлайн-оформленных кредитов в МСБ превысит 60–70 %. Таким образом, цифровизация кредитования ускоряет доступ бизнеса к финансированию и создает основу для устойчивого роста.

Переходя от кредитования к инструментам платежей, отметим, что эквайринг дополняет цифровые сервисы, обеспечивая seamless интеграцию финансирования и расчетов.

Эквайринг является ключевым инструментом безналичных расчетов для юридических лиц [1; 2]. В 2024–2025 гг. Народный банк Казахстана расширил линейку сервисов [3]: POS-терминалы для розничных точек; интернет-эквайринг для e-commerce; QR-платежи для малого бизнеса; мобильный эквайринг для выездной торговли и доставки (таблица 3).

Таблица 3 - Динамика эквайринга 2024–2025

Вид эквайринга	2024 г.	2025 г.	Рост, %
POS-терминалы	11 500 устройств	12 500 устройств	8,7
Интернет-эквайринг	1,8 млн транз.	2,1 млн транз.	16,7
QR-платежи	1,9 млн транз.	2,1 млн транз.	10,5
Мобильный эквайринг	30 тыс. устройств	35 тыс. устройств	16,7

В Таблице 3 наибольший рост демонстрирует интернет-эквайринг, что связано с развитием онлайн-торговли [4]. Мобильный эквайринг показывает высокий процентный рост, отражая востребованность среди МСБ и сервисов доставки [2].

Экономический эффект эквайринга для банка рассчитывается как произведение объема транзакций на комиссию (средняя 1,5–2 %). В 2025 году прирост дохода составил 12–15 %, подтверждая эффективность цифровых сервисов [3; 4].

Распределение по регионам показывает концентрацию в Алматы и Карагандинской области из-за высокой плотности клиентов и инфраструктуры (таблица 4) .

Таблица 4 - Эквайринг по регионам 2025

Регион	POS (устройств)	Интернет (млн транз.)	QR (млн транз.)	Мобильный (устройств)
Карагандинская обл.	3 200	0,5	0,6	8 000
Алматы	4 500	0,8	0,7	12 000
Астана	2 800	0,5	0,4	10 000
Другие регионы	2 000	0,3	0,4	5 000
Итого	12 500	2,1	2,1	35 000

Прогноз на 2026–2027 гг.: интернет-эквайринг вырастет до 2,5–2,7 млн транзакций; POS-терминалы — до 13,5–14 тыс.; мобильный эквайринг — до 50 тыс.; общий доход — рост 15–18 % в год. Рост эквайринга генерирует данные для аналитики, позволяя предлагать персонализированные услуги. Для комплексной оценки проведем SWOT-анализ (таблица 5).

Таблица 5 - SWOT-анализ

Компонент	Описание
Сильные стороны	Лидер по цифровому банкингу, развитая сеть POS и интернет-эквайринга
Слабые стороны	Недостаточная интеграция с ERP, необходимость в обучении клиентов
Возможности	AI-скоринг, расширение API, новые виды платежей
Угрозы	Конкуренция FinTech, киберриски, колебания ставок

Рекомендации по развитию: внедрение AI-скоринга и автоматизированного мониторинга рисков; интеграция с ERP и корпоративными системами для ускорения процессов [1; 2]; разработка сегментированных тарифов эквайринга для повышения

доходности; аналитика транзакций для улучшения клиентского опыта; обучение клиентов через онлайн-семинары. Зарубежный опыт подтверждает эффективность подходов (таблица 6).

Таблица 6 - Зарубежный опыт

Банк / Страна	Продукты	Эквайринг	Результат
JP Morgan, США	AI-скоринг	POS, интернет	Рост оборота 35 %
BNP Paribas, Франция	ERP-интеграция, скоринг	Интернет-эквайринг	Рост доходов 25 %
Сбербанк, РФ	Цифровые кредиты МСБ	QR, интернет	Снижение расходов 20 %
JP Morgan, США	AI-скоринг	POS, интернет	Рост оборота 35 %

В Таблице 6 видно, что интеграция цифровых сервисов повышает скорость, снижает издержки и расширяет базу [1; 2].

Цифровое кредитование и эквайринг существенно повышают эффективность обслуживания юридических лиц [1–3]. Гипотеза исследования подтверждена: цифровые сервисы увеличивают доход и снижают издержки. Внедрение AI, интеграция с ERP и расширение мобильных сервисов обеспечат дальнейший рост и укрепление позиции банка [3; 4]. Зарубежный опыт подчеркивает необходимость постоянного обновления решений.

ЛИТЕРАТУРА

1. Гребенников В.Н. Банковское дело: теория и практика. — М.: Финансы, 2021.
2. Капустин А.А. Цифровизация финансовых услуг. — СПб.: Питер, 2022.
3. Halyk Bank Annual Report 2024–2025. — https://backend.halykbank.com
4. Investing.com. Halyk Bank reports 26,8% rise in 9-month profit. — 2025

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DIGITAL NORMALIZATION OF OVERLOAD: HOW TEMPORARY PROJECTS BECOME A PERMANENT RESPONSIBILITY

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Abstract: *The article examines the phenomenon of digital normalization of overload in the context of digital transformation of organizations. It is shown that the introduction of digital initiatives realized in the form of temporary projects leads to the assignment of additional functions to employees after the completion of the projects without revising the job function and the remuneration system [1;2;13]. The project workload is transformed into a permanent responsibility, which contradicts the principles of human resource management and distribution of responsibility [4-6]. Management and HR risks of the process are identified: latent professional burnout, decreased initiative, concentration of knowledge in a limited circle of specialists and an increase in staff turnover [7; 8]. It is substantiated that digital systems enhance the regime of constant availability of employees and blur the boundaries between core and project activities [9,10]. The author's concept of "project debt" is proposed, which allows considering the accumulated project workload as a form of management risk, similar to the technical debt of IT systems. The practical significance of the results lies in the possibility of using the approach when assessing the consequences of digital projects and managing the human capital of an organization [11;12].*

Keywords: *digitalization of labor; project activities; organizational changes; project workload; HR risks; professional burnout; personnel management; digital transformation.*

In recent years, digital transformation of organizations has increasingly been implemented through project-based activities. The implementation of HR platforms, electronic document management systems, analytical modules, ERP solutions, and other digital tools is typically structured as temporary projects with defined deadlines, goals, and expected results. This form of change management is perceived as manageable and time-bound, which reduces initial risks and simplifies management decision-making.

In practice, however, digital projects significantly change the nature of work and the structure of staff workloads [2,11,13]. After the formal completion of a project, the need for maintenance, configuration, testing, and adjustments to digital solutions does not disappear. On the contrary, it becomes a permanent part of operational activities. Functions initially viewed as temporary are gradually integrated into employees' daily work and cease to be perceived as project-related workload.

This results in a phenomenon that this article defines as the digital normalization of overload. This phenomenon occurs when the additional workload generated by digital projects eventually becomes a stable work norm, without formal institutional recognition. Project-based activities lose their temporary status, but retain a heightened level of responsibility and intensity.

The peculiarity of this process lies in its gradual and subtle nature. Overload is not created by sudden management decisions, but through a consistent expansion of tasks, expectations, and areas of responsibility. Initially, such changes are often perceived as a temporary necessity or an expression of professional flexibility, but over time, they become ingrained in management practices and become mandatory.

For HR departments and organizational management, digital normalization of workload overload represents a significant management challenge. Traditional HR tools—job descriptions, KPI systems, and compensation regulations—are oriented toward relatively stable work models and are poorly suited to capturing projected workload overload. As a result, real changes in staff workload and responsibilities remain outside the formal management framework.

In modern organizational practice, digitalization is increasingly being implemented through a project-based management model. The implementation of digital solutions, regardless of their scale and functional purpose, is framed as a temporary initiative with established deadlines, goals, and expected results. The project format is perceived as a convenient tool for concentrating resources and responsibility, allowing for the implementation of changes without radically overhauling the existing organizational structure [5,14,15].

The dominance of project-based logic is explained by several factors. First, digital changes are complex and cross-functional, making their integration into linear processes difficult. Second, the project-based format creates the managerial illusion of a temporary and controllable workload, avoiding early revisions to staffing schedules, job roles, and compensation systems. Third, the use of projects reduces institutional barriers associated with changes to formal regulations and the distribution of responsibilities.

At the same time, the project logic of digitalization is initially focused on achieving results, rather than analyzing the long-term impact on work organization. Management attention is focused on implementation timelines, system functionality, and project performance indicators, while the transformation of workloads and employee roles is viewed as a secondary effect. This creates the preconditions for a gradual shift in the boundaries between project-based and core activities.

A distinctive feature of digital projects is their high dependence on human involvement, even after formal completion. Unlike traditional organizational changes, digital solutions require constant maintenance, adaptation, and monitoring. However, the project model does not provide clear mechanisms for transferring these functions to the operational environment, resulting in the project workload remaining with the same specialists.

The project-based logic of digitalization is becoming the dominant form of organizational change, but it also lays the foundation for the accumulation of latent burdens. Projects initially conceived as temporary create lasting changes in the nature of work that fail to receive timely institutionalization.

One of the key consequences of the dominance of project-based digitalization is the gradual blurring of the boundaries between core work functions and project-based workloads. Unlike traditional projects, which have clearly defined scopes and distinct roles, digital initiatives are increasingly being implemented through employee engagement, without releasing employees from their core activities or formally redistributing responsibilities.

In practice, participation in digital projects is perceived as a temporary extension of tasks that doesn't require a redefinition of job descriptions. Employees continue to perform their core responsibilities while simultaneously taking on project roles related to the implementation, testing, maintenance, and configuration of digital solutions. This format allows the organization to quickly implement changes, but it creates a persistent workload for key specialists.

Gradually, project work ceases to be perceived as an exception and begins to be integrated into daily activities. Functions initially assigned to the project are assigned to the same employees and are retained after the formal completion of the initiative. Moreover, the boundary between "core work" and "project work" disappears not through management decision, but through everyday work practices.

The digital environment plays a special role in this process, ensuring constant availability and continuity of work. The use of digital platforms, corporate messengers, and cloud systems facilitates extended working hours and heightens expectations of prompt participation. Project tasks are easily integrated into ongoing processes and no longer perceived as an additional burden, even while maintaining increased responsibility.

The result is a hybrid work model in which core activities and project workloads merge into a single flow of tasks. Neither job descriptions nor performance evaluation systems reflect this change, further reinforcing the institutional invisibility of workload overload.

Digital projects, despite their declared temporary nature, often become a mechanism for covertly expanding workloads in practice. Unlike formal job title changes or job description revisions, project-based activities allow for the integration of additional responsibilities into the workflow without the need for institutionalized formalization of these changes. A project serves as an interim form, in which the expansion of functions occurs unnoticed and gradually.

The key feature of this mechanism is that there is no point of return to the original work model. After the digital project is completed, new tasks do not disappear, but are transformed into permanent functions for supporting, monitoring, and developing the implemented solutions. Moreover, it is precisely those employees who were involved in the project during the implementation phase who become the bearers of this additional workload, as they possess the necessary expertise and knowledge.

Project-based logic allows for the legitimization of increased workloads by appealing to employees' professionalism and responsibility. Additional tasks are often framed as temporary assistance, support, or participation in development, which reduces initial resistance. However, over time, these functions cease to be perceived as temporary and become entrenched in management expectations.

The lack of formal documentation of changes means that the increased workload is not reflected in HR documents, the performance appraisal system, or the compensation model. This creates an asymmetry between the employee's actual contribution and their institutional recognition. While the same formal framework for work remains in place, the actual complexity and intensification of the work actually occurs.

A digital project serves as a management buffer, allowing an organization to adapt to changes without revising core HR institutions. However, the accumulation of such solutions creates a hidden workload and lays the foundation for normalizing increased workload as a new norm. This process becomes the starting point for analyzing the mechanisms for digitally normalizing workload.

The digital normalization mechanism for overload is often triggered not by formal management decisions, but by the temporariness effect, which reduces the organization's sensitivity to increased workload. A project is initially perceived as an exception to the norm, and additional work is seen as an acceptable short-term strain that doesn't require a reconsideration of roles, responsibilities, or compensation.

At the individual level, the temporariness effect is shaped by a tolerance for short-term overload. Participation in a project is perceived as a temporary endeavor, linked to development, loyalty, or professional responsibility. Employees accept additional workload based on the expectation that workload will return to its previous level after the project's completion.

This mindset is reinforced by the uncertainty of digital project deadlines. Even with formal completion dates, a sense of temporary control persists: "just a little longer," "we'll push through," "shut it down and breathe a sigh of relief." This reduces the willingness to consider redistributing the workload and institutionally recognizing additional functions.

It's important to note that at this stage, workload is not perceived as a problem. It's viewed as a temporary deviation from the norm, justified by the project's strategic importance. Therefore, there's no demand for formal changes to the work function or compensation system.

At the management level, the temporariness effect transforms into a habituation mechanism. Managers, observing that employees are "tolerating" the project workload, begin to perceive it as

acceptable and manageable. Additional tasks gradually cease to be seen as exceptions and are incorporated into management expectations without formal decision-making.

As the project progresses, management's focus shifts from workload to results. If goals are achieved and processes continue to function, the need to return to the original work model becomes less pressing. As a result, time workload becomes ingrained in management practice, although it remains formally unspecified.

The temporariness effect creates a double distortion: at the employee level, there's an expectation that the overload will soon end, and at the management level, there's an acclimation to the increased workload. The confluence of these two processes forms the basis for the subsequent normalization of the overload and prepares the way for the transition to other mechanisms related to the digital environment and the institutionalization of the new work norm.

Unlike the temporariness effect, which is based on psychological and managerial expectations, digital systems create a different mechanism for normalizing overload—by changing the availability and engagement of employees. Digital infrastructure doesn't simply support work processes; it transforms the very logic of employee presence within the organizational framework.

The use of corporate platforms, electronic document management systems, analytical dashboards, and instant messaging apps creates a regime of continuous, potential activity. Work tasks become accessible at any time, and the ability to interact instantly creates an expectation of prompt response. However, the absence of a formal requirement to work outside established working hours does not prevent the actual increase in engagement.

The unique feature of digital accessibility is that it is perceived as technical neutrality, not a management decision. Employees remain connected not because they are directly required to make additional efforts, but because the digital environment makes participation possible and socially expected. As a result, the boundaries between work and non-work time are blurred without overt violation of formal regulations.

At the same time, responsibility is expanding without being formally documented. Digital systems provide high process transparency, allowing for the rapid identification of deviations, errors, and failures. Information about problems becomes available to a limited number of specialists, who, by virtue of their expertise, are perceived as effectively responsible for the sustainability of digital solutions. This responsibility arises not through job responsibilities, but through ongoing engagement in the digital environment. Digital systems act as a catalyst for constant availability, transforming participation into a continuous state. Overload occurs not through a formal increase in the volume of tasks, but through the expansion of time and role boundaries.

The key stage in the digital normalization of overload is the moment when additional workload ceases to be temporary or auxiliary and becomes a mandatory function. Unlike previous mechanisms, this process is not linked to perception or the technical environment, but to a change in management expectations and the institutional status of the tasks being performed.

The transition to mandatory functions occurs gradually and, as a rule, without a formal management decision. Additional functions continue to be performed out of inertia, since without them, the sustainability of processes is disrupted or the performance of digital solutions is impaired. Over time, failure to perform these tasks begins to be perceived as a violation of professional duties, despite the lack of formal recognition.

One of the key characteristics of this stage is the disappearance of the point of return to the original work model. While in the early stages of a digital project there was an expectation of completing the additional workload, at this stage this expectation is lost. New functions are perceived as an integral part of the work, and the question of returning to the previous scope of responsibilities ceases to be raised.

The disappearance of the point of return is due to the fact that digital processes are not finalized. Systems require constant maintenance, updating, and monitoring, making additional workload structurally necessary. As a result, temporary redistribution of functions is formalized at the practice level, but remains undocumented at the document and compensation levels.

The imposition of additional workloads leads to the formation of a new work norm, in which expanded functionality is perceived as the standard expectation. Employees begin to be evaluated and perceived through the prism of their performance, and their absence is viewed as a lack of engagement or professional failure.

This norm is formed without open discussion or agreement, which makes it particularly persistent. Because the overload is not institutionally codified, it is not subject to revision or compensation. Instead, it is integrated into informal management expectations and reproduced in new digital initiatives. The transformation of additional workload into a mandatory function completes the process of digital normalization of overload. One of the most significant consequences of digital normalization of overload is the erosion of managerial responsibility, accompanied by the concentration of additional workload on a limited number of key specialists. In digital projects, responsibility for process resilience is increasingly distributed not through formal roles, but through actual expertise and access to the system [4,16,17].

In the digital environment, management relies less and less on hierarchical assignment of functions and more on knowledge of processes and systems. Employees with high expertise and early involvement in digital projects become focal points of responsibility. Their role is expanded not through formal appointments, but through the practice of constantly relying on them as bearers of critical knowledge.

In this model, the so-called "reliable" employees—specialists who demonstrate a willingness to take on additional tasks and ensure process stability—bear a special burden. They are the first participants in digital projects and the last to continue monitoring their results. Over time, such employees become the system's bottlenecks, through which key decisions and responses to failures flow.

The overload of "reliable" specialists is exacerbated by the fact that their contributions are taken for granted. Management focuses on results rather than on workload distribution. As a result, responsibility for the sustainability of digital processes is effectively shifted to a limited number of employees without any review of their formal status or working conditions.

The blurring of responsibility also manifests itself in the blurred boundaries between individual and organizational accountability. Errors and failures in digital systems are often perceived as the result of the actions of specific individuals, even when the causes are systemic. This increases the personalization of responsibility and increases pressure on key employees.

Digital normalization of overload leads to the formation of an asymmetrical model of responsibility distribution, in which process sustainability is ensured by overloading individual specialists. This mechanism reduces organizational resilience and creates long-term risks for HR management, which intensify as digital initiatives scale.

Digitally normalizing workload has a significant impact on employee motivation and behavior, but these effects are rarely overtly evident and therefore often go unnoticed by management. Unlike one-off periods of high workload, normalized workload is perceived as a constant background to work and gradually transforms employee attitudes toward work, initiative, and responsibility.

A key feature of this process is the latent nature of burnout. Employees continue to perform their duties, displaying outward loyalty and formally meeting expectations, yet internally experience a persistent feeling of overload and loss of control over their workload. Burnout develops not as an emotional crisis, but as a chronic condition, accompanied by decreased job satisfaction and emotional detachment.

The lack of institutional recognition of additional workload plays a particularly important role here. When overload is not recognized by management and not compensated, it ceases to be perceived as a temporary effort for the sake of results and begins to be interpreted as an unfair redistribution of responsibility. This increases internal tension and reduces employees' willingness to engage long-term.

One of the most persistent behavioral consequences of the digital normalization of overload is a decline in initiative. Employees begin to consciously limit their participation in new projects and

changes, as any additional contribution is perceived as a risk of being assigned a new, unpaid responsibility. Initiative, previously viewed as a source of professional growth, is transformed into a potential threat of overload.

This effect is particularly noticeable among key employees who have already experienced the consequences of expanded functionality. Their behavior becomes more cautious and formally oriented, focusing on performing the minimum necessary tasks within the current workload. As a result, the organization loses the very proactivity and flexibility it had hoped for when implementing digital solutions.

The motivational and behavioral consequences of digital normalization of overload manifest themselves not in sudden disruptions, but in a gradual erosion of engagement and initiative. These changes are difficult to detect using standard HR indicators, but they have a long-term impact on employee resilience and the effectiveness of digital transformation.

The digital normalization of workload impacts not only individual employee motivation and behavior, but also the fundamental functioning of the HR system as a whole. When additional workload becomes a persistent practice without formal enforcement, it begins to undermine institutional HR management mechanisms, making them increasingly less responsive to real changes in work.

One of the key risks is increased staff turnover without obvious cause. Formally, working conditions, compensation system, and job responsibilities remain unchanged, making it difficult to identify the reasons for employee departures. Overwork, not reflected in documents and metrics, is not perceived as a risk factor, although it is precisely this that influences decisions to change jobs, especially among highly qualified specialists.

Employee departures in the context of digital normalization and overload are rarely accompanied by open conflicts or complaints. The decision to change jobs is made individually and is often attributed to external factors, creating the illusion of stability within the organization. The HR system, however, records the consequences, but not the causes, of these changes.

Key specialists, whose workload accumulates faster than others, are particularly vulnerable in this situation. Their departure causes disproportionately high damage, as it entails the loss of unique expertise and disrupts the sustainability of digital processes. However, formal HR metrics do not reflect the escalation of this risk in advance.

The second significant institutional risk is a decline in employee trust in digital initiatives. Digital projects are beginning to be perceived not as a development tool, but as a source of unmanageable workload. This alters employees' attitudes toward subsequent changes and reduces their willingness to participate in new projects.

The lack of management recognition of workload creates a persistent perception that digitalization is being used as a way to redistribute labor without adequate compensation. As a result, the HR system faces resistance to change, which is not overtly expressed but manifests itself in formal participation and a decline in the quality of engagement.

The digital normalization of workload overload creates institutional risks that undermine the effectiveness of the HR system and the sustainability of the workforce. These risks accumulate gradually and often become apparent only in later stages, when the ability to compensate for them is significantly limited.

In the context of digital normalization and overload, traditional HR tools demonstrate limited ability to capture real changes in the nature of work. Job descriptions and KPI systems are initially focused on relatively stable and repetitive work functions, while project-based and digital workloads are dynamic and cross-functional .

Job descriptions typically reflect the core functionality of a position and are designed to ensure its long-term sustainability. Project-based tasks and digital functions are often viewed as temporary or auxiliary and therefore not included in the formal role description. As a result, increased workload occurs without changing the document, creating a gap between the actual and stated workload.

KPI systems, in turn, focus on measurable results and performance indicators, but do not consider the sources and conditions for their achievement. Additional project workload may increase the achievability of indicators or, conversely, increase the risk of failure, but the workload itself is not the subject of assessment. KPIs record results but do not reflect the redistribution of effort and responsibility.

The cumulative nature of workload overload presents a particular problem. Each individual project assignment may appear insignificant and require no formal accounting, but the sum of such tasks creates a persistent excess of the normal workload. Neither job descriptions nor KPIs have mechanisms for capturing the cumulative effect, making the workload institutionally invisible.

Traditional HR tools are proving unsuitable for project-based and digital work. They continue to reflect the formal structure of work, while the actual workload is generated outside of it. This reinforces the normalization of workload overload and creates a managerial illusion of stability that persists until serious personnel and organizational consequences arise.

One of the sustainable mechanisms for digitally normalizing workload overload is creating the illusion of voluntary employee participation in project activities. Project involvement is rarely formalized as a direct management mandate and is more often presented as an opportunity for professional involvement, team support, or the realization of expert potential. This reduces initial resistance and allows for the integration of additional workload without formally renegotiating job responsibilities.

Appealing to the specialist's professional identity plays a key role in this process. Participation in the project is interpreted as a natural extension of competencies and a manifestation of responsibility for the overall result. The phrase "you're a specialist" becomes an unspoken argument, shifting the project burden from a management decision to the employee's personal choice.

However, voluntary participation in this case is conditional. Refusal to participate in the project may be perceived as a lack of commitment, a decrease in loyalty, or a decline in professional motivation. As a result, the choice becomes a formality: the employee accepts additional workload to avoid negative evaluation, even if the project activity falls outside the scope of their primary function.

Over time, the illusion of voluntariness transforms into a stable expectation of participation. Project workload ceases to be discussed as a separate agreement and begins to be perceived as a natural element of the professional role. At the same time, the lack of formal confirmation of voluntariness makes it impossible to renegotiate the terms of participation and compensation [1].

The illusion of voluntariness allows for the legitimization of increased workload without institutionalization. Project participation loses its status as a conscious choice and becomes part of informal management expectations, which further normalizes overload and reduces the transparency of labor relations.

One of the most sensitive consequences of the digital normalization of workload overload is the development of compensation and legal traps arising at the intersection of project activities and the compensation system. At the initial stage, employees' participation in digital projects is often accompanied by additional pay, bonuses, or other forms of incentives, which creates a sense of managerial fairness and the temporary nature of the workload.

However, as project-based functions become integrated into daily operations, additional compensation gradually loses its justification. The project is formally considered complete, and the supporting functions are considered "integrated" into the current work. As a result, the previously paid workload ceases to be considered a basis for separate compensation, despite maintaining increased responsibility and work intensity.

This transition—from additional compensation to its disappearance—creates a key trap: additional workload becomes an obligation without any compensation recognition. Moreover, the lack of a formal change in job function deprives employees of legal grounds for renegotiating pay terms. The overload falls outside the scope of both contractual and compensation regulation.

From a legal perspective, the situation is complicated by the fact that project-based work is not always clearly classified as a change in working conditions. Additional functions are performed

within the same job title or salary, reducing the likelihood of their inclusion in employment documents. In the event of a dispute, proving systematic overload is difficult.

This creates a persistent asymmetry: the organization receives additional labor and expertise on a permanent basis, while the employee loses both the economic and legal basis for protecting their interests. This situation increases mistrust in management decisions and increases the likelihood of latent conflicts that manifest not through formal complaints, but through decreased engagement and staff instability.

Compensation and legal traps are becoming an important element of digital normalization of overload, marking the transition from temporary incentives to an irreversible expansion of obligations. Overcoming them requires not just targeted payments, but a reconsideration of approaches to recognizing and recording projected workload in the HR management system.

In the context of digital transformation, some organizations are developing management practices aimed at recognizing and institutionalizing project overload. These organizations view additional workload not as a side effect of digitalization, but as a manageable element of organizational development that requires recording and regulation.

The key difference between these organizations is the formal assignment of project roles. Participation in digital initiatives is established not as an informal extension of responsibilities, but as a separate area of responsibility with defined tasks, deadlines, and expected results. Project work is viewed as an independent contribution, not as an "add-on" to the main work.

Formalizing project roles allows for a clear delineation of core activities and additional workloads. Employees understand their responsibilities within the project and the obligations that arise upon its completion. This reduces uncertainty and prevents the haphazard assignment of temporary functions to permanent positions.

Organizations that recognize overload place particular emphasis on the timelines of responsibility. Project workloads are defined not only in terms of content but also in terms of timeframes, with predetermined review points. Upon project completion, a management assessment is conducted to determine which functions remain relevant and which should be transferred or eliminated [12,19].

This approach helps avoid the disappearance of the point of no return and maintain a balance between flexibility and sustainability. The additional burden is either institutionalized and compensated for, or eliminated, without becoming an informal work norm.

Unlike management-mature organizations, some companies are building their digital transformation around the overload normalization model. In such systems, additional project workload is not recognized as a separate management object, but is gradually integrated into daily operations without formally recording or revising working conditions.

Normalizing overload leads to systemic staff exhaustion, which manifests not as sudden crises, but as a gradual decline in employees' energy and professional resources. Increased workload is perceived as an inevitable part of digital work, and the expectation of constant project readiness becomes part of the organizational culture.

Moreover, exhaustion is cumulative. Each individual digital initiative may seem manageable and acceptable, but their cumulative impact creates a persistent resource deficit. The lack of mechanisms for capturing and relieving the workload means that staff recovery does not occur even during periods of relative stability.

Systemic exhaustion directly impacts an organization's resilience. Overloaded employees become less resilient to disruptions, errors, and crises. Any additional stress—a new project, changing regulations, or external demands—is imposed on already depleted resources.

Under these conditions, digital initiatives cease to be a source of development and begin to be perceived as a risk factor. The organization maintains formal functionality, but loses its adaptability. Management decisions are made based on a limited number of overloaded specialists, increasing the system's vulnerability and increasing dependence on individual employees.

Organizations normalizing workload are faced with a digitalization paradox: while striving for increased efficiency, they create conditions for a gradual loss of resilience. Workload becomes an invisible yet system-forming factor, undermining the organization's human resources and management [2,10,13].

Project overload in a digital environment can be viewed not only as a personnel or motivational issue, but also as an early indicator of the degradation of management practices. Unlike formal crises associated with falling performance indicators or open conflicts, overload manifests itself long before visible negative consequences and therefore often remains outside the scope of management attention.

One of the key signs of management degradation is the loss of the ability to distinguish between development and exploitation of personnel. When project participation is no longer regulated and compensated, and additional workload is perceived as a natural resource, the organization effectively substitutes human endurance for management decisions. This maintains external stability, but reduces the quality of management.

Project overload develops before an open crisis and mass employee departures. At this stage, formal indicators may remain within normal limits, and digital projects may demonstrate successful implementation. However, the system's internal stability has already been compromised: key specialists are overloaded, motivation is reduced, and trust in management decisions is weakened.

It is at this stage that overload serves as a signaling function. It indicates a mismatch between the pace of digital change and the organization's ability to manage its consequences. Ignoring this signal leads to the accumulation of risks, which subsequently manifest as turnover, process failures, and a decline in decision quality.

Project overload can be viewed as a diagnostic indicator of management maturity. Organizations that recognize it early and respond with management tools maintain resilience and adaptability. Those that ignore this signal face management degradation, the consequences of which become apparent only when the scope for adjustment is significantly limited.

In the context of digital transformation, additional project workload accumulates not chaotically, but according to a specific management logic. To understand this, this article introduces the concept of project debt —the accumulated volume of unrecorded, uncompensated, and institutionally unstructured project functions that continue to be performed after the formal completion of digital initiatives.

Project debt accumulates when an organization achieves results through temporary workload redistribution but fails to revisit the work architecture. Projects are closed from a management perspective, but not from a labor perspective. As a result, the organization begins to "use" additional staff effort in the same way that IT systems exploit technical debt—postponing the resolution of a structural problem for the sake of short-term efficiency.

An analogy with technical debt helps us better understand the nature of this phenomenon. In IT practice, technical debt arises when a system works, but its architectural flaws are put off until later. Similarly, project debt arises when digital solutions function, but the workload they rely on is not recognized or managed.

Like technical debt, project debt doesn't lead to immediate failure. On the contrary, in the early stages, it creates the illusion of efficiency: projects are implemented faster, costs remain under control, and staffing doesn't increase. However, as project debt accumulates, the organization's dependence on overloaded specialists increases, process resilience decreases, and the cost of any error or departure of a key employee increases.

The key characteristic of project debt is its low observability. It isn't reflected in reporting, isn't captured in HR metrics, and isn't directly reflected in financial performance. Formally, projects are completed, systems are operational, and KPIs are met, which creates the illusion of management prosperity.

Project debt's distributed nature adds to its invisibility. The burden accumulates piecemeal—through support, monitoring, testing, consultations, and corrections—and is rarely perceived as a

single, unified volume of additional work. Each element, taken individually, appears acceptable, but their combined impact creates a persistent risk.

Project debt is a specific form of management risk for digital organizations. It accumulates unnoticed, has no immediate consequences, but significantly reduces the system's long-term resilience. Understanding and conceptualizing project debt is a prerequisite for the transition from normalizing overload to managed digital labor transformation.

One of the fundamental mechanisms for accumulating project debt is the substitution of human effort for management and organizational decisions. Under time or resource constraints, emerging issues in digital projects are resolved through the involvement of specific specialists rather than through process changes, role redistribution, or system customization.

In the early stages, this approach is perceived as effective: specialists compensate for shortcomings, provide backup for the system, and ensure its stability. However, as similar situations recur, this temporary solution turns into a permanent dependence on specific individuals. The organization stops investing in structural solutions, relying instead on personal reliability and expertise.

As a result, project debt accumulates in the form of informally established expectations: someone will always "check," "fix," "suggest," or "tweak." These functions are not defined as separate tasks, but become mandatory for maintaining the functionality of digital solutions.

The second mechanism for accumulating project debt is the lack of full project closure in terms of labor. Formally, a digital initiative can be considered complete: the system has been implemented, the report has been prepared, and the goals have been achieved. However, issues of maintenance, support, and development remain outside the project scope.

Post-project support functions are not assigned a separate status or redistributed. They are automatically assigned to project participants, as they possess the necessary knowledge and access to the system. Thus, the project continues undisclosed, becoming a constant source of additional workload.

The lack of a formal "project closure" process means that each new digital project adds another layer of project debt. The organization accumulates ever more unfinished business obligations without realizing their total scope and consequences.

Project debt accumulates through the systematic substitution of human effort for structural decisions and the lack of institutionalized project completion at the labor level. These mechanisms make project debt persistent and difficult to resolve, requiring a shift from spontaneous digitalization to conscious management of the consequences of digital change.

Recognizing the existence of project debt does not, in itself, reduce project overload. Managing this risk requires targeted management and HR decisions, focused not on targeted compensation, but on systemic equalization of workload and responsibility. In this context, project debt should be considered a management risk comparable in importance to financial and operational risks.

The first step in managing project debt is to document it. Additional functions arising from digital projects should be identified and described as a separate workload layer. This doesn't require formally rewriting job descriptions, but rather recognizing the actual areas of responsibility associated with the maintenance, monitoring, and development of digital solutions.

Recording makes project debt observable and negotiable. As long as the additional burden remains undocumented, it cannot become the subject of a management decision. Recognizing project debt moves the problem from an informal practice to a managerial level.

The second element of project debt management is compensation. This can take various forms—financial, temporary, or career-related—depending on the nature and intensity of the additional workload. It is crucial that project debt not remain an unpaid resource for the organization.

Compensation serves not only an economic but also an institutional function. It signals recognition of additional contributions and reduces the risk of overwork becoming a normalized management practice. The absence of compensation, on the contrary, perpetuates the asymmetry between actual work and its reward.

The third and most challenging element of project debt management is load shedding. Not all functions arising from digital projects should be retained by the same specialists on a permanent basis. Some should be redistributed, automated, or institutionalized as separate roles and processes.

Relieving the burden requires a conscious management choice in favor of long-term sustainability, even if this requires additional resources. For HR and management, this stage requires moving beyond short-term efficiency and recognizing the limits of human resilience as a management factor.

Project debt management requires coordinated efforts by HR and management to capture, compensate, and mitigate additional burdens. This approach transforms digital transformation from a source of hidden risks into a manageable process based on a balance between technological advancement and human resource sustainability, (Tables 1, and 2).

Table 6 - Project debt of a digital organization as an object of management analysis

Measurement analysis	What is observed in practice	Management interpretation	Strategic risk
Load source	Project functions are retained after the formal completion of initiatives	Projects are closed in a managerial, but not labor-intensive manner	Growth of unregistered employment
Form of fixation	The functions are not documented.	The burden exists outside the institutional framework	Inability to revise working conditions
Bearer of debt	Limited circle of key specialists	Project debt is personalized	Critical dependence on individual employees
The moment of manifestation	We only see it when there are failures or when people leave	Project debt is latent	Delayed management crisis
Impact on motivation	Formal loyalty in the face of internal burnout	Loyalty becomes a resource for exploitation	Loss of initiative and trust
Reflection in HR metrics	Not recorded by standard indicators	The HR system "doesn't see" the overload	The illusion of personnel stability
Economic effect	Short-term resource savings	Long-term cost increases	Increased cost of errors and turnover
Controllability	Lack of formal decisions	Project debt is not an object of management	Accumulation of systemic risk

Table 2 - Project debt and management maturity levels of a digital organization

Criterion	Low management maturity	Transitional model	High managerial maturity

Relation to design load	Seen as a natural part of the job	Partially recognized, without systemic solutions	Considered as a managed resource
Project debt status	Not recognized as a problem	Recorded post factum	It is taken into account in advance
Closing digital projects	Formal, without load analysis	Analyzed, but without consequences	Includes labor-intensive closing
Distribution of responsibility	Personalized for key employees	Partially formalized	Institutionally distributed
Compensation for additional load	Absent or episodic	Irregular, situational	Systematic and transparent
The role of HR management	Reactive, post factum	Advisory	Architectural and proactive
Resilience of digital processes	Dependent on individuals	Moderately stable	High and scalable
Attitude to initiative	Initiative leads to overload	Initiative is encouraged to a limited extent	The initiative is institutionally protected
Long-term effect	Accumulation of hidden risks	Partial stabilization	Managed development

In the context of digital transformation, the key management challenge is not the existence of project backlog per se, but the lack of tools for measuring and comparing it. Personnel overload associated with digital projects is typically detected after the fact—through burnout, turnover, or process failures. Transitioning from reactive to proactive management requires a diagnostic tool that can identify the accumulation of project backlog before critical consequences occur. In this regard, the article proposes a project debt index (Project The Debt Index (PDI) is an integral indicator that reflects the degree of accumulation of unrecorded and uncompensated project load in a digital organization.

The PDI index is designed to assess the gap between: the actual project load remaining after the completion of digital initiatives; the level of its institutional recognition, compensation and governance.

Unlike traditional HR metrics, the PDI does not directly measure productivity or engagement. Its purpose is to diagnose hidden management risks associated with using project workload as a "free resource."

The index can be used: HR management - to audit the consequences of digital projects; management - to assess management sustainability; when planning new digital initiatives - as a preventive assessment tool.

The PDI index is based on several analytical dimensions reflecting the key mechanisms of project debt accumulation. Each dimension is assessed separately, after which an integrated indicator is formed.

Basic PDI measurements: The degree to which project functions are maintained after the formal completion of projects. The level of formal recording of additional workload. The nature of project workload compensation. Concentration of project responsibility. Manageability of workload removal.

Each dimension reflects not the intensity of work, but the quality of management decisions related to the project workload.

Using the PDI index allows you to: identify areas of hidden overload before fluidity and burnout occur; compare departments and projects by the level of workload manageability; make decisions on the redistribution of functions and resources; evaluate the impact of digital initiatives not only on the results of implementation, but also on their impact on the labor system. Incorporating PDI into HR audit and strategic management practices allows us to view digital transformation not only as a technological process, but also as a process of changing labor relations that requires systematic support.

Like any integrated indicator, the PDI has limitations. It requires high-quality management analysis and cannot be automatically calculated without expert assessment. Furthermore, its values depend on industry, organizational, and cultural characteristics.

In the future, the PDI index may be expanded by: industry coefficients; integration with HR analytics and BI systems; use in dynamics to assess the effect of management decisions.

Introducing the Project Index The Debt Index completes the conceptual framework of the study, translating the authors' idea of project debt from an analytical perspective to an applied one. The PDI allows for the institutionalization of project overload management and its treatment as a measurable and manageable risk, rather than an inevitable consequence of digitalization, (Table 3).

Table 3 - Calculation of the project debt index (Project Debt Index (PDI)

Instructions: Each criterion is assessed on a scale of 0–2 points. The higher the final score, the greater the level of accumulated project debt.

Evaluation criteria	0 points (low debt)	1 point (moderate debt)	2 points (high debt)
Maintaining project functions after project completion	Functions removed or transferred	Functions are partially preserved	The functions are fully preserved
Formal fixation of additional load	Documented	Partially recorded	Not recorded
Design load compensation	Systematic and transparent	Episodic	Absent
Availability of a procedure for labor closure of a project	The procedure is mandatory	The procedure is formal	There is no procedure
Concentration of project responsibility	Distributed institutionally	Partially personalized	Focused on individuals
Dependence of processes on specific specialists	Minimum	Moderate	Critical
Reflection of project workload in HR metrics	It is taken into account	It is taken into account indirectly	Not taken into account
The impact of project load on initiative	The initiative is protected	The initiative is cautious	Initiative is suppressed

Organizational Response to Overload	Proactive	Reactive	Ignoring

Index calculation. Maximum score: 20.
Formula: PDI = sum of points for all criteria
Interpretation of PDI values.

PDI range	Interpretation	Management characteristics
0–6	Low project debt	High managerial maturity
7–13	Moderate project debt	Transitional model
14–20	High project debt	Critical management risk

The analysis conducted in this article demonstrates that the digital transformation of organizations is accompanied not only by technological and process changes, but also by a profound restructuring of the nature of work. The implementation of digital initiatives in a project-based format creates conditions under which temporary workloads gradually lose their exceptional status and become a sustainable norm of work activity.

The article argues that the digital normalization of overload is formed through a set of interconnected mechanisms: the effect of temporariness, constant digital accessibility, and the institutionalization of additional burdens as mandatory functions. These processes unfold gradually and, as a rule, remain outside the scope of formal management, making overload a structural rather than an individual phenomenon.

It has been shown that normalizing workload overload leads to systemic management and HR risks, including the diffusion of responsibility, overloading of key specialists, latent burnout, decreased initiative, and loss of trust in digital initiatives. Of particular danger is the institutional invisibility of these processes, where formal HR tools continue to document stability, while the actual resilience of the organization declines.

As a conceptual response to the identified problem, the author proposes a model of project debt in a digital organization. Project debt is viewed as accumulated management risk arising from unrecorded and uncompensated project functions that persist after the completion of digital projects. The analogy with technical debt highlights the delayed nature of the consequences and the illusion of short-term efficiency.

The practical significance of this study lies in the development of a management approach to addressing project overload based on its recording, compensation, and resolution. Considering project debt as a management tool expands the HR department's and management's toolbox, enabling the integration of the human factor into digital development strategies.

Digitalization without managing project overload creates the risk of degrading management practices and undermining organizational resilience. Recognizing and managing project debt allows organizations to maintain a balance between technological development and workforce resilience, turning digital transformation into a manageable and long-term effective process.

LITERATURE

1. Davenport T., Kieron D. Working in the era of smart machines. - M.: Alpina Publisher, 2021.
2. OECD. The Future of Work: OECD Employment Outlook. — Paris: OECD Publishing, 2019.
3. International Labor Organization. Work for a Brighter Future: Global Commission on the Future of Work. — Geneva, 2019.
4. Armstrong M. Human Resource Management Practice. - St. Petersburg: Piter, 2020.
5. Drucker P. F. Management: tasks, responsibilities, practice. - M.: Mann, Ivanov and Ferber, 2019.
6. Boxall P., Purcell J. Strategy and Human Resource Management. — London: Palgrave Macmillan, 2016.
7. Ulrich D., Brockbank W. HR Competencies for the Next Generation. - Alexandria: SHRM Foundation, 2018.
8. Edmondson A. The Fearless Organization. — Hoboken: Wiley, 2019.
9. Schwab K. The Fourth Industrial Revolution. — Geneva: World Economic Forum, 2016.
10. World Economic Forum. Jobs of Tomorrow: Mapping Opportunity in the New Economy. — Geneva, 2020.
11. Becker G. Human capital: investments in education and vocational training. - Moscow: HSE Publishing House, 2018.
12. ISO 30414:2018. Human resource management—Guidelines for internal and external human capital reporting.
13. World Economic Forum. Global Human Capital Trends. — Geneva, 2021.
14. Kotter J. Ahead of Change. - M.: Alpina Publisher, 2020.
15. Mintzberg G. Structure in a Fist: Creating an Effective Organization. — St. Petersburg: Piter, 2017.
16. Sull D., Sull C. Why Good Companies Go Bad in Digital Transitions. — MIT Sloan Management Review, 2018.
17. Cascio W., Boudreau J. Investing in People: Financial Impact of Human Resource Initiatives. - FT Press, 2011.

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INVISIBLE ACCOUNTABILITY IN DIGITAL ORGANIZATIONS: MANAGERIAL DRIFT BETWEEN PEOPLE AND SYSTEMS

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Abstract: *This article examines the phenomenon of invisible managerial responsibility, which arises in the context of the digitalization of modern organizations. It demonstrates that with the increasing use of algorithms and the introduction of digital platforms and automated management systems, accountability for results increasingly loses its clear subjectivity. With formalized processes and transparent digital traces, it becomes unclear who exactly makes decisions and who bears responsibility for their consequences. The argument is made that in digital organizations, responsibility ceases to be directly tied to job titles, functions, or workloads and begins to "drift" between people, processes, and systems. This creates a situation in which employees and specialists are held accountable for results over which they have no real managerial influence, while key management decisions remain impersonal or are attributed to digital tools. This article introduces and develops the author's concept of managerial responsibility drift, describes its main forms (vertical, horizontal, and algorithmic), and analyzes the implications of this phenomenon for management sustainability, the role of the HR function, and the quality of management decisions. Particular attention is paid to how invisible responsibility is concentrated in expert roles (HR, analytics, IT) that lack formal decision-making authority.*

Keywords: *digital governance, managerial responsibility, algorithmization, HR architecture, digital risks, organizational resilience*

Digital transformation of organizations is traditionally viewed as a process of increasing the transparency, controllability, and predictability of management decisions. According to classical management logic, the implementation of information systems, algorithms, and platforms should reduce uncertainty, minimize the human factor, and strengthen control over performance. However, in practice, digitalization is increasingly accompanied by a paradoxical effect: with the availability of detailed data, formalized processes, and recorded digital traces, it is becoming less and less clear who bears managerial responsibility for decisions and their consequences [9-11,15,16].

In modern digital organizations, results are typically achieved not by a single actor, but by the interaction of multiple actors —employees, managers, expert functions, and digital systems. At the same time, responsibility for these results remains personalized and typically assigned to specific individuals, often outside the key management decision-making loop. A situation arises in which the system functions, performance indicators are achieved, but the individual responsible remains unclear or is only identified post-mortem, during a failure or conflict.

This problem is particularly acute in the context of the algorithmization of management processes. Decisions are increasingly made based on the logic of digital systems, pre-established rules, and automated calculations, while humans perform the function of confirming, supporting, or

adjusting the decision already made by the algorithm. As a result, the phenomenon of "responsibility without a decision" is emerging, in which formal responsibility remains with the individual, but actual management influence is limited or absent [10,11].

Despite the obviousness of these processes, managerial responsibility remains one of the least understood aspects of digital governance. Unlike functions, processes, and metrics, responsibility rarely becomes an independent object of analysis, design, and management. As a result, digital organizations face not so much a lack of regulations or technologies as a loss of clarity regarding the distribution of responsibilities between people and systems.

The research logic begins with an analysis of classical notions of managerial responsibility and continues with an examination of the specifics of the digital environment and the development of the author's concept of managerial responsibility drift. The final section of the article is devoted to formulating principles for restoring responsibility as a manageable category in digital organizations and identifying practical guidelines for HR and management.

In traditional management theories, responsibility was viewed as an integral element of organizational hierarchy and was directly linked to the role occupied, the scope of authority, and decision-making power. The classical model assumed that management results are the result of the conscious action of a specific subject with sufficient information, power, and the ability to influence processes.

Within this logic, responsibility had clear boundaries and was assigned to a position or management role. The decision maker bore personal responsibility for its consequences, and the management system ensured that the scope of responsibility corresponded to the level of authority granted. This approach allowed for the development of clear lines of accountability and served as the basis for monitoring, performance evaluation, and management training.

The classical model of responsibility also relied on the principle of predictability of management processes. It was assumed that management decisions are the result of rational choice in a relatively stable environment, while the influence of external factors and intermediaries can be taken into account and compensated for within the management hierarchy. Responsibility in this context served not only as a sanctioning mechanism but also as an instrument of management discipline, ensuring the consistency of actions and the stability of the organizational structure [1-5].

It's important to note that in the pre-digital era, management decisions were typically made with limited automation and minimal external system intervention. Technological tools were auxiliary in nature and lacked independent decision-making logic. This allowed for a direct connection to be maintained between the action, the result, and the responsible party, making responsibility a visible and manageable category.

The classical model of responsibility was based on three interrelated elements: role, which defines the subject's place in the management structure; authority, which provides the ability to influence processes; and decision, which serves as the point at which managerial responsibility arises. It was the consistency of these elements that ensured management transparency and the stability of the organizational system.

One of the key foundations of classical managerial responsibility was the principle of correspondence between the outcome of management activity and the specific decision-maker. This principle can be roughly formulated as "one result—one responsible party." It ensured clarity of management logic and allowed for the correlation of achieved results with specific management actions and decisions.

Within this approach, outcomes were viewed as the consequence of a chain of management decisions, in which responsibility was consistently assigned to the management level where the key decision was made. This model allowed for the construction of a transparent accountability system in which the causes of successes and failures could be easily identified. Accountability served not only as a control mechanism but also as a tool for management learning, enabling decision adjustments and improving management quality.

The principle of personalized responsibility also played a significant role in shaping management culture. Awareness of personal responsibility for results encouraged managers to make more deliberate decisions, considering risks and the long-term consequences of their actions. In this logic, responsibility was closely linked to a manager's professional reputation and their position in the organizational hierarchy.

It should be emphasized that this principle assumed a relative clarity of cause-and-effect relationships in management processes. Even in the context of teamwork and distributed functions, it was assumed that there was a subject with the final decision-making power and, therefore, responsibility for the final outcome. This made it possible to maintain managerial certainty even in complex organizational structures.

The "one result, one subject" principle served as the foundation of the classical model of managerial responsibility, ensuring its personalization, predictability, and institutional stability. It is this principle that is increasingly under pressure in the context of digitalization and algorithmization of management processes, becoming one of the key prerequisites for the transformation of responsibility in modern organizations [1,3,6].

The classic model of managerial accountability, based on the personalization of decisions and the principle of "one result, one subject," demonstrates high effectiveness in relatively stable environments and the linear logic of management processes. However, as organizational systems become more complex and digital technologies are introduced, its explanatory and practical potential begins to diminish significantly.

One of the key limitations of the classical model is the assumption that a management decision can be unambiguously associated with a specific outcome. In digital processes, outcomes are increasingly formed as the cumulative effect of multiple actions, algorithms, settings, and external factors, each of which, individually, is not decisive. Under such conditions, identifying a single responsible party becomes difficult, and sometimes fundamentally impossible [7-9].

The mediation of management decisions by digital systems introduces additional tension into the classical model. Algorithms, automated rules, and built-in data processing logic begin to perform the functions of pre-selection, calculation, and even recommendation of management decisions. At the same time, formal responsibility for the final decision remains with the individual, despite the fact that their influence on the parameters and logic of the digital system may be limited. A structural gap arises between responsibility and actual management control.

The next limitation is the growth of collective decision-making, characteristic of digital organizations. Project teams, cross-functional groups, and distributed management systems blur the boundaries of individual responsibility without offering adequate mechanisms for institutionalizing it. As a result, responsibility is either formally distributed among several actors or effectively loses its personalization and becomes apparent only when problems arise.

Finally, the classic responsibility model poorly accounts for the dynamic nature of digital processes. Management decisions in the digital environment are often continuous and corrective, making it difficult to pinpoint the moment responsibility arises. Responsibility ceases to be tied to a single decision and increasingly manifests itself as a diffuse set of obligations without clear time and role boundaries.

In the context of digital processes, the classical model of management responsibility faces a number of structural limitations associated with the complexity of cause-and-effect relationships, the algorithmization of decisions, and the collective nature of management.

One of the key features of the digital management environment is the transfer of a significant portion of management logic to algorithms, automated rules, and digital platforms. Decisions are increasingly being formed not through individual management choices, but as a result of a system based on predetermined parameters, models, and constraints. At the same time, the role of the human being is being transformed from decision-maker to decision-maker, supporter, or adjuster.

Under such conditions, a phenomenon arises that can be characterized as the "responsibility without decision" effect . Formally, responsibility for the outcome remains with the individual, but

actual influence on the content of the decision is limited by the algorithm. The individual is responsible for the consequences of the decision without having full control over its logic, initial data, or calculation rules [10,11].

This effect is particularly noticeable in systems where algorithms perform evaluation, ranking, or automated selection functions. In such cases, management decisions take on the character of "recommended" or " predetermined ," and deviations from these require additional justification and can be perceived as a management risk. As a result, responsibility for the outcome remains personal, while the real scope for management choice narrows.

It's important to note that algorithmization itself doesn't eliminate responsibility; on the contrary, it reconfigures it . Responsibility shifts from the level of conscious choice to the level of system operation. People become responsible for the correct use of a digital tool, even if they weren't involved in its development or configuration. Thus, responsibility arises not at the moment of decision-making, but when consequences arise, which reinforces its post-factum nature.

The "responsibility without decision" effect leads to a structural imbalance between responsibility and control. Formal accountability remains, but managerial influence is distributed between the individual and the system. This creates the preconditions for a further blurring of accountability and forms the basis for managerial drift, which manifests itself as digital processes become more complex and collective decision-making expands.

The development of digital technologies is accompanied by an expansion of collective decision-making. Cross-functional teams, project committees, digital system approvals, and distributed working groups are becoming standard management formats. Formally, such models are intended to improve decision quality by engaging expertise and reducing individual risks. However, from a management accountability perspective, collective decision-making often has the opposite effect.

In collective decision-making, responsibility loses its personalized character. Decisions are formed as a result of the combined participation of several actors , with the contribution of each becoming difficult to separate from the overall outcome. The formula "everyone participated" gradually displaces the principle of personal accountability, and responsibility begins to be perceived as distributed and, therefore, less binding [13,14].

The digital environment amplifies this effect by formalizing collective participation. Approvals are recorded in systems, comments and edits are stored in digital traces, but the presence of multiple participation marks does not lead to the emergence of a clear subject of responsibility. On the contrary, the more actors involved in the process, the more difficult it is to determine who had the final decision-making power and should bear responsibility for its consequences.

Another characteristic of digital collective decisions is that responsibility is often asymmetrical. At the moment of decision-making, responsibility is perceived as general and vague, whereas when negative consequences arise, a retrospective search for a specific entity occurs. In such situations, responsibility often "sinks" to those participants in the process whose involvement was most visible or whose role was related to supporting the decision rather than its formulation.

Collective responsibility in digital organizations often devolves into de facto irresponsibility at the decision-making stage and selective personalization of responsibility during the impact analysis stage. This undermines managerial clarity and creates conditions in which responsibility ceases to be a risk-prevention tool and becomes a mechanism for post-factum response. As the digitalization of management processes deepens, digital systems are beginning to be perceived not only as decision-support tools but also as independent participants in the management system. Algorithms, platforms, and automated procedures create a stable logic of action that is reproduced independently of specific management actors. As a result, the digital system effectively begins to perform functions traditionally inherent to a manager: defining acceptable decision options, limiting choices, and setting criteria for evaluating results.

In management practice, this manifests itself in a shift in focus from the question "who made the decision?" to the question "how did the system work?" Phrases like "it's set up that way," "the system doesn't let it through," and "the algorithm calculates it that way" are becoming commonplace

explanations of management consequences. At the same time, the digital system acquires the status of a pseudo- government agent —it influences the outcome, but cannot be held accountable in the institutional sense [9,11,15].

The peculiarity of this pseudo-entity lies in the asymmetry between influence and accountability. A digital system can determine the course of processes and shape management decisions, but responsibility for their consequences invariably remains with an individual or group of individuals. Thus, a structural gap arises: control is exercised through the system, but responsibility lies outside the system. This increases the uncertainty of responsibility and complicates its conscious assignment at the decision-making stage.

An additional complication is that digital systems are often perceived as neutral and objective. Algorithmic logic is given the status of rational and impartial, which reduces managers' willingness to challenge the system's decisions or take responsibility for adjusting them. As a result, responsibility for the consequences of digital decisions is further distanced from management choices and shifted to the realm of technical support.

The transformation of a digital system into a pseudo- governance entity completes the process of blurring the boundaries of responsibility in the digital environment. Algorithmization limits individual choice, collectivity erodes personalization, and the system creates the illusion of autonomous governance.

In digital organizations, there is an increasing discrepancy between the formal distribution of responsibility and how it is implemented in management practice. Responsibilities defined in regulations, job roles, or management decisions often misalign with the actual distribution of influence over processes and results. This results in a situation in which responsibility exists simultaneously in two dimensions—formal and actual—with no consistent alignment between them.

Formal responsibility is typically defined in advance and codified in organizational documents. It establishes a nominal bearer of responsibility and serves as the basis for accountability. However, in a digital environment, process management is accomplished through complex systems, algorithms, and collaborative interactions, which shifts real managerial influence toward those entities capable of ensuring the functionality and sustainability of these systems.

Actual responsibility gradually concentrates among those process participants who possess expertise, access to the system, and the ability to intervene quickly. They are the ones who "keep" the process running, resolve failures, interpret results, and make decisions under conditions of uncertainty. However, their role is often not accompanied by a formal mandate to make management decisions, which creates an asymmetry between responsibility and authority [7,8,16].

This shift is not the result of a conscious management decision, but rather a consequence of the organization's adaptation to digital complexity. Formally appointed responsible individuals retain their status and accountability, but actual management is increasingly exercised "at the system level"—by those capable of ensuring its functioning. Thus, responsibility is beginning to shift from formally assigned roles to the actual bearers of management risks.

It's important to emphasize that managerial responsibility drift is not the result of individual managers or employees' mistakes. It is a systemic effect of digitalization, where the speed of change and the complexity of processes outpace the ability of organizational structures to capture and redistribute responsibility. As a result, responsibility ceases to be a predetermined management category and becomes reactive, emerging as problems and deviations arise.

The transition from the formal assignment of responsibility to its actual bearer is becoming a key mechanism of managerial drift. Understanding this process allows us to view the erosion of responsibility not as an isolated failure, but as a structural change in the management logic in digital organizations, which requires further analysis and a rethinking of management approaches.

One of the characteristic features of managerial responsibility drift in digital organizations is the shift in the moment of its manifestation. In classical management logic, responsibility arises at the point of decision-making and accompanies its implementation. In the digital environment,

responsibility increasingly becomes visible only after a failure, conflict, or negative outcome, acquiring a distinctly post-factum character [14,15].

In the stable operation of digital systems, managerial responsibility remains latent. Decisions are perceived as the result of processes, algorithms, or collective actions, and the question of responsibility is not addressed. However, when the established logic is disrupted—a data error, a system failure, or a result that doesn't meet expectations—a retrospective mechanism for identifying the responsible party is triggered.

This mechanism typically does not analyze the decision architecture or the management prerequisites for the failure. Instead, it identifies a specific individual or group of individuals whose participation in the process can be documented or digitally traced. In such cases, responsibility is attributed to those who supported the process, validated decisions, or ensured technical implementation, even if their influence on the initial decision parameters was limited.

The post-factum nature of responsibility is reinforced by digital transparency. The presence of action logs, logs, and change histories creates the illusion of manageable responsibility, allowing for the formal reconstruction of the chain of actions. However, reconstructing the sequence of actions is not equivalent to identifying the management decision. As a result, responsibility is replaced by a record of participation, and accountability by the appearance of control.

A key role in this process is played by the asymmetry between the ability to prevent an error and the ability to be held accountable for its consequences. Those with access to the system and the ability to respond quickly are the most vulnerable to ex post facto liability. They are the ones who most often become the focal point of management attention in crisis situations.

Accountability in digital organizations is increasingly losing its preventative function and becoming a reactive tool used to explain what happened rather than to prevent management risks.

One of the most persistent manifestations of managerial accountability drift in digital organizations is its consistent downward shift within the hierarchy. As management processes become more complex and the role of digital systems increases, accountability is increasingly concentrated at levels directly involved in the operational implementation of decisions, rather than at those responsible for their strategic formulation.

This process is driven by the fact that in a digital environment, managerial influence is increasingly determined less by formal management positions and more by access to the system, data, and the ability to intervene quickly. Senior managers retain decision-making authority and overall accountability, but actual management is increasingly exercised by specialists with expertise and technical control over processes.

The downward shift in responsibility is accompanied by a change in its content. Responsibility ceases to be associated with the choice of management strategy and begins to be associated with ensuring the smooth operation of the system. Expertise replaces the managerial mandate: those who are capable of "fixing," "configuring," or "explaining" become the de facto bearers of responsibility, even if they are not involved in the formation of the initial management decisions [10,11,16].

Digital action recording plays a particularly important role in this process. The lower the hierarchical level, the more detailed the recording of employee participation in processes, which increases their vulnerability to accountability. Conversely, top-level management decisions often remain generalized and difficult to correlate with specific consequences. As a result, responsibility is unevenly distributed: it is concentrated in areas with greater visibility but less managerial authority.

This shift in responsibility leads to a structural distortion of management logic. Responsibility and authority become divergent, undermining motivation, reducing the quality of management decisions, and creating a persistent sense of unfairness in the management system. At the same time, the organization itself may maintain outward signs of effectiveness, making the problem less noticeable in the early stages.

The downward shift in responsibility is not a random aberration, but a natural consequence of the digitalization of management. It completes the process of managerial responsibility drift, in which responsibility loses its connection to the decision-making level and is assigned to those forced to

ensure the functioning of the system. In the context of managerial responsibility drift, digital organizations are faced with the phenomenon of secondary assignment of responsibility to professional roles that lack a formal management mandate. These roles primarily include HR specialists, analysts, and IT personnel who ensure the operation and maintenance of digital management systems. It is at these levels that responsibility for the consequences of management decisions begins to "settle," despite the lack of authority to make them.

This process is structural in nature and is determined by the specific nature of the digital environment. HR and expert functions act as intermediaries between management decisions and their practical implementation. They interpret system requirements, adapt them to specific situations, and ensure data accuracy and compliance with regulations. As a result, these specialists are most closely linked to the final outcome, even if they were not involved in the initial management decisions.

A distinctive feature of secondary responsibility assignment is its tacit nature. Responsibility is not formalized in writing and is not accompanied by a redistribution of management authority. It arises as a result of expectations on the part of management and the organization as a whole: if a system is not functioning properly or the results raise questions, support specialists are the first to receive complaints and requests for clarification. Thus, responsibility is established not through formal assignments, but through day-to-day management practices.

It's important to note that this assignment of responsibility is reinforced by the digital transparency of specialists' activities. The actions of HR, analysts, and IT personnel are recorded in detail in systems, making their participation in processes visible and easily reproducible. At the same time, high-level management decisions often remain aggregated and poorly traceable, contributing to an asymmetrical distribution of responsibility [18,20].

As a result, HR and expert functions begin to act as "risk holders" for digital solutions. They are responsible for the correct execution, compliance with regulations, and process stability, but lack the authority to review the system's strategic parameters. This creates a persistent gap between responsibility and managerial influence, which is becoming one of the key characteristics of invisible accountability in digital organizations.

The secondary assignment of responsibility to specialists without mandates is a systemic effect of the digitalization of management. It is not a consequence of the failures of individual functions, but rather reflects a shift in the architecture of management responsibility, in which HR and expert roles become risk concentration points without a corresponding expansion of management authority.

One of the key consequences of secondary responsibility assignment in digital organizations is a persistent mismatch between the scope of responsibility and the level of managerial authority. Those effectively responsible for the results of digital processes typically lack the authority to change their architecture, revise rules, or adjust strategic decision parameters.

In classical management logic, responsibility implies the right to choose and influence outcomes. In the digital environment, this connection is broken. HR specialists, analysts, and IT functions are responsible for the proper operation of systems, the interpretation of data, and compliance with regulations, but they are not involved in setting goals, evaluation criteria, or the logic behind management decisions. Their role is reduced to ensuring the functionality of a given system, not managing it.

The discrepancy between responsibility and managerial authority also manifests itself in the nature of interactions with management. Unauthorized specialists are often called upon to explain the consequences of decisions, identify the causes of deviations, and mitigate risks, but are rarely involved in discussing alternatives and strategic tradeoffs. As a result, responsibility is asymmetrical: it is realized in the form of reporting and explanations, but is not accompanied by the opportunity to influence underlying management assumptions [13,18].

This gap is exacerbated by the formalization of digital processes. Regulations, algorithms, and system settings are perceived as fixed and non-negotiable at the operational level. Any deviations from the established logic require approval at a higher management level, further limiting the managerial influence of those actually responsible for the outcome.

Over the long term, the mismatch between responsibility and managerial authority leads to a distortion of the managerial role of expert functions. Responsibility ceases to be perceived as an element of professional autonomy and begins to be associated with risk and vulnerability. This reduces the willingness of specialists to take initiative, participate in process improvement, and propose alternative solutions, which negatively impacts the sustainability of digital governance.

Invisible accountability in digital organizations creates a complex set of organizational consequences that rarely manifest as sudden crises but gradually undermine management resilience. Unlike formally documented management errors, these consequences are cumulative and accumulate unnoticed, remaining outside the scope of traditional management oversight.

One of the key effects is a change in employee attitudes toward responsibility itself. When responsibility is not accompanied by the right to influence, it ceases to be perceived as an element of a professional role and begins to be viewed as a source of risk. Under such conditions, a defensive management logic develops, focused not on improving decisions but on minimizing personal vulnerability. This leads to increased formalism, caution, and a decreased willingness to take initiative.

Another significant consequence is the distortion of management communication. Unclear boundaries of responsibility encourage constant clarifications, approvals, and attempts to assert non-involvement in potential negative outcomes. Management interactions increasingly shift from discussing the content of decisions to discussing procedures and formal signs of participation, which reduces the speed and quality of management processes.

At the organizational cultural level, invisible accountability fosters a persistent sense of uncertainty and loss of control. Employees and specialists actually responsible for results don't understand the limits of their authority and which decisions can be revised. This creates internal tension, which doesn't always manifest as open conflict, but is reflected in decreased engagement, increased latent dissatisfaction, and a gradual withdrawal from management processes [13,16].

Of particular significance is the fact that these consequences are often not recognized by management as a management problem. While formal performance indicators are maintained, an organization may be perceived as functioning stably, yet internal management relationships are already deformed. In this sense, invisible accountability acts not as a localized failure, but as an indicator of deeper changes in management logic.

Managerial responsibility is one of the fundamental elements of a sustainable management system, as it links management decisions to their consequences and establishes a framework for accountability. In this sense, the degree of visibility and clarity of responsibility can be considered an indicator of an organization's managerial maturity. Where responsibility becomes diffuse or loses its agency, management gradually loses its architectural integrity.

In digital organizations, the degradation of governance rarely manifests itself through a formal abdication of responsibility. Instead, responsibility may be retained at the level of declarations, regulations, and organizational charts. However, its practical connection to management decisions disappears. Responsibility ceases to serve as a guide for decision-making and is transformed into a tool for explaining events that have already occurred [7,16].

A characteristic sign of managerial degradation is the loss of connection between strategic decisions and operational consequences. Senior management levels set goals, indicators, and development directions without clearly assigning responsibility for risks and side effects. As a result, responsibility shifts to levels that ensure decision implementation but are not involved in their formation. Under such conditions, management loses its ability to self-correct .

The disappearance of accountability as a manageable category leads to a weakening of the decision architecture. Management actions become fragmented, focused on localized problem resolution rather than systemic root cause management. Digital process transparency merely masks this degradation, creating the illusion of control in the absence of real managerial agency.

The loss of visible accountability in digital organizations is not a side effect of digitalization, but a symptom of a deeper management transformation. Where it is impossible to determine in

advance who is responsible for the consequences of decisions, management ceases to be holistic and begins to function in a reactive mode. This allows us to consider invisible accountability as an early indicator of management degradation, manifesting itself long before formal crises and organizational failures.

One of the most paradoxical effects of digitalization of management is the simultaneous increase in process transparency and a decrease in managerial clarity. Modern digital systems allow for the recording of actions, decisions, and changes in a highly detailed manner, generating extensive data sets on an organization's activities. However, having complete information on the progress of processes does not guarantee an understanding of who is responsible for their results .

Digital transparency in this context manifests itself primarily as transparency of operations, not management decisions. Systems record what was done and by whom , but rarely reflect why a particular decision was made or who had final approval authority. As a result, management logic becomes "dissolved" in the data flow, and accountability is replaced by the appearance of control [15].

The fragmentation of management decisions plays a special role in this process. In digital organizations, decisions are often made not as a single management act, but as a series of approvals, automated checks, and algorithmic calculations. Each element of this chain is transparent and documented, but the overall responsibility for the final result remains unclear. Management clarity gives way to procedural correctness.

This gap between transparency and clarity increases managerial uncertainty. Managers and specialists see deviations, metrics, and anomalies, but cannot always clearly determine at what level and at what point a decision to correct should be made. Under such conditions, responsibility begins to be perceived as distributed and conditional, which reduces the willingness to make management decisions that take long-term consequences into account.

Invisible management responsibility can be considered one of the earliest and most sensitive indicators of systemic risks in digital organizations. Unlike performance indicators, staff turnover, or engagement levels, the transformation of responsibility manifests itself long before negative consequences become measurable and obvious to management analytics.

A characteristic feature of this signal is its "silent" nature. Responsibility does not formally disappear, but it loses its clear boundaries and predetermined vehicle. Management decisions continue to be made, processes function, and targets are formally met, but at critical points in the system, there is no clarity regarding who has the right and responsibility to intervene before negative consequences occur. This creates a hidden vulnerability that can remain undetected for a long time [16,18].

The early nature of this risk manifests itself in a change in management behavior. Employees and specialists begin to avoid situations involving decision-making at the intersection of functions and systems, preferring to act strictly within the framework of formal procedures. Managers, in turn, increasingly rely on digital reports and metrics without understanding the distribution of responsibility. These behavioral shifts are not captured by standard metrics, but significantly reduce management adaptability.

A particular danger is that accountability, as a signal of systemic risk, is often interpreted post-factum. An organization only becomes aware of the problem when a conflict arises, turnover spikes, or management failures occur, when restoring the management architecture requires significant effort. At this stage, accountability no longer functions as a preventative mechanism, but as an object of redistribution and scapegoating.

Invisible responsibility should not be viewed as a side effect of digitalization, but as a diagnostic marker for underlying management dysfunction. Identifying and analyzing it allows for the early detection of the degradation of management logic, before it manifests itself as formal crises, (Table 1).

Table 1 - Invisible responsibility as an indicator of the state of governance in digital organizations

Analytical focus	Managerially mature configuration	Configuration with control degradation
Responsibility status	Clearly recorded before decisions are made	It appears after the fact, during failures
Linking responsibility to decision	Responsibility follows the point of managerial choice	Responsibility follows the elimination of consequences
Subject of management responsibility	Defined and institutionally recognized	Vague, situational , or informal
The role of digital systems	Support and strengthening of management decisions	Substitution of managerial choice
Management response to failures	Analysis of solutions and architecture	Finding a responsible person
Organizational learning	Mistakes are transformed into management conclusions	Errors are localized and forgotten
Employee perception of responsibility	Responsibility as a management logic	Responsibility as a personal risk
Dynamics of Trust in Management	Building trust and predictability	The growth of latent mistrust
Long-term sustainability	Adaptability and managed development	Latent degradation before crises

In the context of digitalization, managerial responsibility is no longer a statically fixed category but is becoming dynamic. To describe this phenomenon, this article introduces the concept of managerial responsibility drift, which refers to the gradual shift of responsibility from formally assigned management roles to the actual bearers of risks and the consequences of management decisions.

Managerial drift in responsibility is not limited to errors in the distribution of functions or deficiencies in regulation. It involves a more profound shift in management logic, in which responsibility loses its connection to the point of decision-making and begins to follow the process of its implementation. Responsibility "moves" along with those capable of maintaining the functioning of the system, interpreting its logic, and eliminating deviations, regardless of their formal status [9-11,16].

A key characteristic of managerial drift is the divergence of three elements of management: decision, influence, and responsibility. Decisions may be fixed at one level (strategic or regulatory), influence is distributed among the system and collective actors, and responsibility is concentrated at the operational or expert level. As a result, responsibility ceases to serve as a guide for management actions and becomes a reactive mechanism, activated when problems arise.

It's important to emphasize that managerial drift in responsibility is not a result of a deliberate evasion of responsibility on the part of management. It emerges as a systemic effect of the digital environment, in which the speed of change, algorithmization, and fragmentation of decisions outpace the organization's ability to institutionalize responsibility. In this sense, drift is not a management failure, but a form of adaptation to digital complexity, with long-term negative consequences.

A distinctive feature of managerial accountability drift is its invisibility in the early stages. Formal accountability structures continue to exist, management roles are preserved, and numerical indicators appear stable. However, actual accountability has already shifted and manifests itself primarily in crisis situations, making it difficult to diagnose and manage.

Managerial drift of responsibility can be seen as a specific form of transformation of managerial responsibility in digital organizations, in which responsibility ceases to be a predetermined managerial category and begins to be reproduced situationally, depending on the configuration of systems, processes, and actors.

For a more precise analysis of managerial drift, it is useful to identify its main forms, which differ in the direction of responsibility shift and the nature of managerial distortions. This study proposes a typology that includes vertical, horizontal, and algorithmic drift of responsibility. These forms are not mutually exclusive and, in practice, often combine, enhancing the overall effect of invisible responsibility.

Vertical responsibility drift is characterized by a shift in responsibility from strategic and tactical management levels to operational and expert levels. Formally, decisions are made at the upper levels of the hierarchy, but actual responsibility for their implementation and consequences is concentrated with the specialists who ensure the functioning of processes and systems. As a result, responsibility "flows" downward, following the opportunity for operational intervention rather than the right to make decisions.

Horizontal responsibility drift manifests itself in the blurring of responsibilities between functional and project boundaries. In the context of cross-functional collaboration and distributed digital processes, responsibility ceases to belong to a specific unit or role and shifts between process participants depending on the current situation. This form of drift results in responsibility becoming temporary and contextual, not firmly assigned to any one entity.

Algorithmic drift of responsibility is associated with the increasing role of digital systems in management decision-making. In this form of drift, responsibility shifts from humans to algorithmic logic, but institutionally remains with humans. Algorithms determine decision parameters, limit choices, and generate acceptable scenarios, while humans are responsible for the outcome without fully controlling the system's logic. This creates the illusion of controllability while actually lacking managerial influence.

Each of the identified forms of drift distorts managerial responsibility in its own way, but their overall effect is the loss of integrity within the managerial framework. Responsibility ceases to be the connecting element between decision and outcome and begins to function as a distributed and situational attribute of digital processes.

Management drift has a complex impact on the resilience of digital organizations, affecting both the quality of management decisions and the system's ability to adapt over the long term. Unlike short-term management failures, the consequences of drift are cumulative and manifest gradually, making it difficult to recognize and address them in a timely manner.

One of the key consequences is a decline in decision control. When responsibility loses its connection to the decision-making level, management loses the ability to make targeted adjustments. Decisions are made and implemented, but their consequences are not subject to conscious management analysis, as there is no entity interested in systematically assessing risks and alternatives. As a result, management shifts to a mode of maintenance rather than development.

Another significant effect is the weakening of the organization's institutional memory. Responsibility not assigned to specific roles and decisions does not generate sustainable management conclusions. Mistakes and deviations are perceived as local events, rather than as the result of specific management decisions or architectural miscalculations. This limits the organization's ability to learn from experience and increases the likelihood of similar problems recurring.

Managerial accountability drift also negatively impacts trust in the management system. Employees and specialists who effectively bear responsibility without a managerial mandate gradually lose confidence in the fairness and predictability of management decisions. This reduces

their willingness to engage in complex management situations and increases their focus on formal procedural compliance rather than meaningful performance management [16,18].

At the level of organizational resilience, accountability drift reduces the adaptability of digital systems. In the face of change or external shocks, an organization with blurred lines of accountability is less capable of rapid and coordinated responses. The lack of clearly assigned responsibility for risks and consequences leads to slower decision-making and increased management costs in crisis situations (Table 2).

Table 2 - Management conditions for the formation of responsibility drift in digital organizations

Analytical measurement	Traditional management model	Digital-algorithmic model
Locus of responsibility	Assigned to a management role	Distributed between the process and the digital system
The moment of actualization of responsibility	Coincides with the adoption of a management decision	Occurs when a deviation, failure or incident occurs
Relationship between responsibility and authority	Responsibility is institutionally linked to power	Responsibility correlates with access and expertise
Primary Responsibility Bearer	The manager as a subject of decision	Expert, operator, accompanying function
The role of the digital system	Management decision support tool	The bearer of management logic and constraints
Mechanism for assigning responsibility	Formal (mandate, position, regulations)	Actual (participation, appearance of action, reaction)
Type of management responsibility	Proactive, prevention-oriented	Reactive, consequence-oriented
The function of responsibility in management	A guideline for decision making	Mechanism for interpretation and distribution of consequences

Restoring managerial responsibility in digital organizations is impossible without reconsidering the fundamental principle of its establishment. A key condition for sustainable management is the correspondence between the scope of responsibility and the right to truly influence management decisions. In this article, this principle is formulated as "responsibility = right to influence," emphasizing the inadmissibility of assigning responsibility without granting managerial authority [1,3,19].

In the digital environment, this principle takes on particular significance, as influence on outcomes is increasingly exercised not through formal management roles, but through access to the system, data, and decision-making mechanisms. If an entity is responsible for the consequences of a digital decision, it must be able to influence the algorithm's parameters, the logic of the process, or the conditions of its application. Otherwise, responsibility loses its managerial meaning and becomes a form of institutional risk.

The principle of congruence between responsibility and influence necessitates abandoning the practice of assigning responsibility post-factum. Responsibility must be defined before decisions are made and accompanied by a clear understanding of the management actions available to the

responsible entity. This allows responsibility to be transformed from a reactive mechanism into a preventative tool for management risks.

It's important to note that the right to influence does not necessarily mean the right to make decisions alone. In digital and collaborative governance settings, influence can be exercised through participation in system configuration, the development of evaluation criteria, veto power, or a mechanism for mandatory decision review. It's critical that accountability does not arise outside the scope of these opportunities.

One of the central conditions for restoring managerial responsibility in digital organizations is a clear delineation of responsibilities between humans and the digital system. Otherwise, the system continues to act as a pseudo-subject of management, and responsibility remains suspended between the algorithm and the human, exacerbating managerial drift.

Digital systems do not possess accountability in the institutional sense, but they do shape management logic through algorithms, rules, and constraints. Consequently, human accountability cannot be interpreted as responsibility for the system's actions as a whole. It must be related to the management decisions made before, during, and within the context of the digital tool's use. This implies a distinction between responsibility for selecting a system, responsibility for configuring it, and responsibility for implementing its results.

In management practice, these levels are often confused. The person using the system finds themselves responsible not only for the correctness of their own actions but also for the architectural decisions built into the digital tool, decisions over which they have no influence. This confusion undermines the managerial logic of responsibility and leads to the emergence of a "responsible for everything" effect, in which responsibility becomes undefined and uncontrollable.

Delineation of responsibility implies institutional recognition that the digital system is the bearer of logic, but not the subject of responsibility. Responsibility for the consequences of digital decisions should be distributed among those management levels that made decisions on the system's implementation, defined its parameters, and established the rules for its use. The system user is responsible for the correct application within the given logic, but not for the logic itself [9-11].

Capturing management decision points is particularly important. In digital processes, such points are often blurred and hidden within algorithms and regulations. Identifying and documenting them allows for the return of responsibility to the management decision and prevents its shift to operational levels. This creates the basis for meaningful digitalization risk management.

Restoring managerial responsibility in digital organizations cannot be viewed as a task for individual specialists or functions. It requires a systemic transformation of the management architecture, in which management and HR play a key role as bearers of the organization's institutional logic. Their task is not to redistribute individual responsibilities, but to create conditions under which responsibility once again becomes a manageable and meaningful category.

The role of management in this process is to recognize responsibility as a management resource, not just a control mechanism. Managers define the framework for digital solutions, approve system parameters, and define the acceptable boundaries of management influence. It is at this level that the points of accountability for the selection of digital tools, their architecture, and their strategic implications must be established. Without such recognition, any attempts to redistribute responsibility at the operational level remain formal and unsustainable.

In a digital organization, the HR function serves as the link between management decisions and their implementation. In the context of managerial responsibility drift, HR often becomes a secondary hub for accountability, without the necessary managerial authority. Restoring accountability requires rethinking HR's role—from a support function to an architectural one, participating in the design of management responsibility frameworks and accountability mechanisms.

The practical role of HR is to identify gaps between responsibility and influence, as well as to initiate management dialogue on the distribution of responsibility in digital processes. This includes participation in the development of regulations, discussion of the logic of digital systems, and the

development of criteria for evaluating management decisions. Thus, HR becomes not the bearer of responsibility for others' decisions, but a moderator of its meaningful distribution [18,20].

Collaboration between management and HR enables accountability to transform from a reactive tool into an element of management design. This requires abandoning the practice of assigning responsibility post-factum and moving toward proactively assigning responsibility during the design phase of digital solutions. As a result, accountability regains its preventative function and becomes a factor in the sustainability of a digital organization.

Reconstructing management responsibility in a digital environment is only possible with coordinated actions by management and HR aimed at restoring the link between decision, influence, and consequences. (table 3) .

Table 3 - Principles for Restoring Management Accountability in Digital Organizations

Principle	What is being adjusted?	Management effect	Risk of ignoring
Alignment of responsibility and influence	The gap between the consequences and the possibility of management influence	Bringing responsibility back into the decision-making loop	Formation of "responsible persons without authority"
Delineation of responsibility between the individual and the system	Mixing system errors and user actions	Reducing false personal responsibility	Algorithmic blame shifting
Preliminary fixation of liability	Post-factum appointment of those responsible	Prevention of management failures	Reactive crisis management
Institutional consolidation of decision points	The Invisibility of Management Choice	Improving the manageability of digital processes	The illusion of automatic control
The architectural role of HR	Secondary "settling" of responsibility on HR	HR's transition from risk bearer to responsibility moderator	HR as the ultimate responsible party
Management reflection on digital solutions	Lack of analysis of the consequences of digitalization	Organizational learning	Recurrence of system errors
Transparency of boundaries of responsibility	Uncertainty of the subjects of responsibility	Increasing trust in management	Increase in latent resistance

The digitalization of management has significantly changed decision-making methods, the nature of management processes, and the distribution of managerial influence within organizations. However, along with increased transparency, automation, and speed of decision-making, it has led to a less visible but systemically significant effect— the erosion of managerial responsibility [10-12,15,16]. In digital organizations, responsibility increasingly ceases to be a predetermined managerial category and becomes apparent only after the fact, when problems or deviations arise.

The analysis conducted in this article demonstrates that invisible responsibility is not an isolated failure or a consequence of insufficient formalization. It is formed as a result of structural changes in management logic associated with the algorithmization of decisions, collective forms of management, and the transformation of digital systems into pseudo-subjects of the management process. Under these conditions, responsibility begins to drift between management levels, functions, and systems, losing its connection to the decision-making point and the right to exercise managerial influence.

Expert and support functions, including HR, analytics, and IT, are particularly vulnerable in this configuration. These roles are often assigned secondary responsibilities, without formal mandates or the ability to influence the architecture of management decisions. This leads to distorted management relationships, reduced initiative, loss of trust in the management system, and a gradual weakening of organizational resilience.

The article demonstrates that invisible accountability can be considered an early indicator of managerial degradation in digital organizations. Unlike traditional HR metrics and performance indicators, the transformation of accountability manifests itself long before open conflicts, turnover, or crises arise. Identifying it allows for the early diagnosis of underlying management risks and the transition from reactive management to a conscious reconstruction of the management architecture [16, 17, 18].

The practical significance of this study lies in its formulation of principles for restoring managerial accountability in the digital environment. Key among these principles are the alignment of responsibility and influence, the delineation of human and systemic accountability, and a rethinking of the role of HR and management as architects of managerial accountability. Implementing these principles allows us to restore accountability's preventative function and view it as a resource for sustainable management, rather than a mechanism for finger-pointing.

Digitalization without a clear distribution of management responsibility poses a more serious threat to organizations than the absence of automation per se [11,16]. Understanding and managing responsibility in digital organizations is becoming a prerequisite for their long-term sustainability, manageability, and ability to evolve in the face of increasing technological complexity.

LITERATURE

1. Drucker PF Management: Tasks, Responsibilities, Practices. — New York: Harper & Row, 1973.
2. Mintzberg H. The Structuring of Organizations. — Englewood Cliffs: Prentice-Hall, 1979.
3. Mintzberg H. Managing. — San Francisco: Berrett -Koehler, 2009.
4. Simon H. A. Administrative Behavior. — New York: Free Press, 1997.
5. Weber M. Economy and Society. — Berkeley: University of California Press, 1978.
6. Crozier M. The Bureaucratic Phenomenon. — Chicago: University of Chicago Press, 1964.
7. Perrow C. Complex Organizations: A Critical Essay. — New York: McGraw-Hill, 1986.
8. Galbraith JR Designing Organizations: Strategy, Structure, and Process. — San Francisco: Jossey -Bass, 2002.
9. Orlikowski WJ The Duality of Technology: Rethinking the Concept of Technology in Organizations. — Organization Science, 1992.
10. Zuboff S. In the Age of the Smart Machine. — New York: Basic Books, 1988.
11. Zuboff S. The Age of Surveillance Capitalism. — New York: PublicAffairs , 2019.
12. Davenport TH, Harris JG Competing on Analytics. — Boston: Harvard Business School Press, 2007.
13. Edmondson A. The Fearless Organization. — Hoboken: Wiley, 2019.
14. Power M. The Audit Society: Rituals of Verification. - Oxford: Oxford University Press, 1997.
15. Bernstein ES The Transparency Trap. — Harvard Business Review, 2014.
16. Sull D., Sull C. Why Good Companies Go Bad in Digital Transitions. — MIT Sloan Management Review, 2018.
17. OECD. The Path to Becoming a Data-Driven Public Sector. — Paris: OECD Publishing, 2019.
18. World Economic Forum. Global Human Capital Trends. — Geneva, 2021.
19. ISO 9001:2015. Quality Management Systems — Requirements (regarding the responsibility and management role).
20. ISO 30414:2018. Human Resource Management - Guidelines for Internal and External Human Capital Reporting.

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ӘДІЛ ҚҰННЫҢ КӘСІПОРЫННЫҢ ИНВЕСТИЦИЯЛЫҚ ТАРТЫМДЫЛЫҒЫНА ӘСЕРІ

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Аннотация: *Мақалада әділ құнды қолданудың кәсіпорынның инвестициялық тартымдылығына әсері қарастырылады. Қаржылық есептілікте әділ құнды пайдалану инвесторлар үшін ақпараттың шынайылығы мен салыстырмалылығын арттыратыны негізделеді. IFRS 13 стандарты талаптары тұрғысынан әділ құнның инвестициялық шешімдер қабылдаудағы рөлі талданады. Зерттеу нәтижелері әділ құнды қолдану кәсіпорынның нарықтық бағалануы мен инвестициялық сенімділігін арттыруға ықпал ететінін көрсетеді.*

Тірек сөздер: *әділ құн; инвестициялық тартымдылық; қаржылық есептілік; IFRS 13; инвестициялық шешімдер.*

Қазіргі экономикалық жағдайда кәсіпорындардың инвестициялық тартымдылығы олардың қаржылық есептілігінде ұсынылатын ақпараттың сапасына тікелей байланысты. Инвесторлар шешім қабылдау кезінде активтердің нақты экономикалық құнын, қаржылық тәуекелдерді және болашақ табыстылықты бағалауға ұмтылады. Осы тұрғыда бухгалтерлік есепте әділ құнды қолдану қаржылық ақпараттың өзектілігі мен сенімділігін арттырудың маңызды құралы ретінде қарастырылады.

Қаржылық есептіліктің халықаралық стандарттарына сәйкес әділ құн активтер мен міндеттемелердің нарықтық жағдайға жақын бағасын көрсетуге мүмкіндік береді. Сондықтан әділ құнды қолдану кәсіпорынның инвестициялық тартымдылығын арттырудың теориялық және практикалық аспектілерін зерттеу өзекті болып табылады.

Мақаланың мақсаты – бухгалтерлік есепте әділ құнды қолданудың кәсіпорынның инвестициялық тартымдылығына әсерін талдау және оның қаржылық есептілік ақпаратын қалыптастырудағы рөлін анықтау.

Инвестициялық тартымдылық кәсіпорынның инвесторлар үшін экономикалық тұрғыдан қызықты болу деңгейін сипаттайды. Ол қаржылық тұрақтылық, табыстылық, активтердің сапасы және басқару тиімділігі сияқты көрсеткіштер арқылы анықталады. Бұл көрсеткіштердің барлығы қаржылық есептілік мәліметтеріне негізделеді.

Егер есептілік ақпараттары нақты экономикалық жағдайды толық көрсетпесе, инвесторлардың шешім қабылдау процесі бұрмалануы мүмкін. Осы себепті бағалау әдістерінің дұрыстығы инвестициялық тартымдылықты қалыптастыруда шешуші рөл атқарады.

IFRS 13 стандартына сәйкес әділ құн – нарық қатысушылары арасындағы қалыпты мәміле барысында активті сату немесе міндеттемені өтеу бағасы. Бұл анықтама әділ құнды нарықтық категория ретінде сипаттайды және оны тарихи құннан түбегейлі ажыратады [2].

Тарихи құн активтердің өткен кезеңдегі сатып алу бағасына негізделсе, әділ құн олардың ағымдағы нарықтық жағдайдағы нақты экономикалық құнын көрсетеді. Осы арқылы

қаржылық есептілік пайдаланушылары кәсіпорынның қаржылық жағдайын неғұрлым шынайы бағалай алады.

Әділ құнды қолдану кәсіпорынның инвестициялық тартымдылығына бірнеше бағытта әсер етеді. Біріншіден, активтердің әділ бағалануы баланс құрылымын нақтылап, кәсіпорынның нарықтық құнын дұрыс көрсетуге мүмкіндік береді.

Екіншіден, әділ құн капиталдың жеткіліктілігі мен қаржылық тұрақтылық көрсеткіштерін объективті бағалауға ықпал етеді. Бұл өз кезегінде инвесторлардың тәуекелді бағалауына және болашақ табыстылықты болжауына оң әсер етеді.

Үшіншіден, әділ құн негізінде дайындалған есептілік ақпараттың ашықтығын арттырып, инвесторлар сенімін күшейтеді. Сенімді ақпарат инвестициялық шешімдердің тиімділігін арттырудың негізгі факторы болып табылады.

Сонымен қатар әділ құнды қолдану белгілі бір қиындықтармен де сипатталады. Атап айтқанда, белсенді нарықтың болмауы жағдайында бағалаудың субъективтілігі артады. IFRS 13 стандартының 3-деңгейіне жататын бағалаулар кәсіби пайымдауға негізделетіндіктен, инвестициялық тәуекелдердің өсуіне әкелуі мүмкін [3].

Сондықтан әділ құнды қолдану кезінде бағалау әдістерін негіздеу, ақпаратты толық ашу және кәсіби стандарттарды сақтау аса маңызды.

Қорыта айтқанда, әділ құнды қолдану кәсіпорынның инвестициялық тартымдылығын арттыруда маңызды рөл атқаратынын көрсетті. Әділ құн қаржылық есептіліктің шынайылығы мен өзектілігін қамтамасыз етіп, инвесторлар үшін ақпараттың сапасын арттырады.

Сонымен бірге әділ құнды тиімді қолдану кәсіби бағалау, ашық ақпараттық орта және халықаралық стандарттарды сақтау жағдайында ғана оң нәтиже береді. Осылайша әділ құнды қолдану кәсіпорынның инвестициялық тартымдылығын және ұзақ мерзімді тұрақты дамуын қамтамасыз етудің маңызды құралы болып табылады.

ҚОЛДАНЫЛҒАН ӘДЕБИЕТТЕР ТІЗІМІ

1. 2024 Қазақстан Республикасының Заңы (2007). Бухгалтерлік есеп пен қаржылық есептілік туралы: №234-III ҚРЗ, 28 ақпан 2007 ж. (09.01.2024 ж. өзгерістерімен және толықтыруларымен). Астана: Қазақстан Республикасының Әділет министрлігі.
2. Халықаралық Қаржылық Есептілігінің Стандарты (IFRS 13) «Әділ құнның бағасы» [Электрондық ресурс]. – Қолжетімділік режимі: https://online.zakon.kz/Document/?doc_id=31241932&pos=4;-105#pos=4;-105
3. International Accounting Standards Board (IASB). Conceptual Framework for Financial Reporting. London: IASB, 2021.

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МИНТАҚАВИЙ ҲАМКОРЛИКНИНГ РИВОЖЛАНИШИДА ЛОГИСТИКАНИНГ РОЛИ (МАРКАЗИЙ ОСИЁ ДАВЛАТЛАРИ МИСОЛИДА)

ОЧИЛОВА АЗИЗА ҒАЙРАТОВНА
Ўзбекистон Республикаси Фанлар академияси ҳузуридаги Ўзбекистоннинг энг янги тарихи масалалари бўйича Мувофиқлаштирувчи-методик маркази таянч докторанти

Аннотация: *Ушбу илмий мақолада ҳам логистика инфратузилмасининг Марказий Осиё давлатлари ҳамкорлигида, иқтисодиётининг ривожланишидаги ўрни ва ролига бағишланган. Мақоланинг мақсади Марказий Осиёда иқтисодий ҳамкорликни кенгайтириш учун логистика ташаббуслари ва қўшма лойиҳаларни яратиш ҳамда уларни амалга ошириш муҳимлигини кўрсатиш ва асослаш ҳисобланади. Мақоланинг долзарблиги шундан иборатки, бугунги кунда Марказий Осиё давлатлари ўртасидаги иқтисодий ҳамкорликка логистикани ривожлантириш орқали эришиш каби долзарб масалалар кўндаланг турибди.*

Калит сўзлар: *логистика, Марказий сиё, ривожланиш, ҳамкорлик, иқтисодиёт, келажак*

Аннотация: *Данная научная статья посвящена месту и роли логистической инфраструктуры в сотрудничестве стран Центральной Азии и их экономическом развитии. Цель статьи продемонстрировать и обосновать важность создания и реализации логистических инициатив и совместных проектов для расширения экономического сотрудничества в Центральной Азии. Актуальность статьи заключается в том, что сегодня решаются такие насущные вопросы, как достижение экономического сотрудничества между странами Центральной Азии посредством развития логистики.*

Ключевые слова: *логистика, Центральная Азия, развитие, сотрудничество, экономика, будущее.*

Abstract: *This research article examines the place and role of logistics infrastructure in cooperation and economic development among Central Asian countries. The article aims to demonstrate and substantiate the importance of creating and implementing logistics initiatives and joint projects to expand economic cooperation in Central Asia. The article is relevant given the pressing issues of achieving economic cooperation between Central Asian countries through logistics development.*

Keywords: *logistics, Central Asia, development, cooperation, economy, future.*

Бугунги глобал иқтисодиётда логистиканинг аҳамияти ошиб бораётганини кузатиш мумкин. Бу бутун дунё бўйлаб товарлар, хизматлар ва маълумотларнинг ҳаракатини осонлаштиришда, иқтисодий ўсишни, самарадорликни ва рақобатбардошликни оширишда муҳим роль ўйнайди. Ривожланган логистика инфратузилмаси савдо, инвестициялар ва истеъмолни енгиллаштириш орқали иқтисодий ўсишни рағбатлантиради. Бу минтақалар ва мамлакатлар ўртасида товарларнинг ҳаракатланишини таъминлайди, иқтисодий ривожланиш ва жамиятнинг фаровонликка интилишига хизмат қилади.

Юртимизда охирги йилларда бу соҳага катта эътибор берилмоқда. Бу борада Президент Ш.Мирзиёев: “Бу соҳа — иқтисодиётнинг қон томири. Транспорт ва логистикани янги босқичга олиб чиқмасак, иқтисодиётнинг барқарор ривожини таъминлай олмаймиз, [1]– дея таъкидлаган эдилар.

Мақолада логистиканинг тарихига ҳам эътибор қаратилган. Маълумотларга қараганда, логистика атамаси биринчи илмий асарларнинг яратувчиси XIX аср бошидаги француз ҳарбий мутахассиси А. Жомини ҳисобланади. У логистикани “қўшинларни маневр қилишнинг

амалий саньати” деб таърифлаган. Демак, логистика дастлаб ҳарбий хизматчиларнинг асбоб-ускуналар ва материалларни қандай қабул қилиш, сақлаш ва кўчиришини тасвирлаш учун ишлатиладиган ҳарбий атама эди. Бу атама ҳозирда бизнес соҳасида, айниқса ишлаб чиқариш соҳасидаги компаниялар томонидан ресурсларнинг таъминот занжири орқали қайта ишланиши ва кўчирилишида кенг қўлланилади.

Логистиканинг келиб чиқиши ва тарихига назар ташласак, у узоқ тарихий жараённи босиб ўтганини кузатамиз. Демак, логистика тарих давомида инсоният тараққиётида ҳал қилувчи роль ўйнаганига гувоҳ бўламиз. Логистиканинг келиб чиқишидан товарлар ва материалларни ташиш бўйича биринчи саъй-ҳаракатлар билан бугунги энг мураккаб бошқарув ва тарқатиш тизимларигача, логистика бизнес дунёсининг асосига айланиб борган. [7]

Алоҳида эътибор бериш керакки, логистика тарихининг ҳар бир босқичи технологик тараққиёт ва ташиш, сақлаш ва бошқариш усулларининг ўзгариши билан ажралиб туради. Бундан мақсад товарлар ва хизматларнинг самарадорлиги ва оқимини ошириш бўлиб хизмат қилган.

Логистика тарихи биринчи инсоният цивилизацияларига бориб тақалади, ўшанда одамлар омон қолиш учун товарларни етказиб бериш ва кўчириш зарурлигини тушундилар. Масалан, Миср империяси (милоддан аввалги 3300-332 йиллар) озиқ-овқат ва асосий товарлар билан барқарор таъминлаш учун ташиш ва сақлаш усулларини ишлаб чиқди. Кейинчалик Рим империяси (милоддан аввалги 27-476 йиллар) ўзининг улкан ҳудуди бўйлаб юк ва қўшинларни ташишни осонлаштириш учун Рим йўллари деб номланувчи қуруқлик ва денгиз йўлларининг кенг тармоғини яратди. Римликлар, шунингдек, денгиз транспорти учун кемалардан фойдаланишда уларнинг йўналишлари бўйлаб таъминот омборларини ташкил этишган.[7] Шу тариқа бу даврда Европа ва Осиёни боғловчи савдо йўллари ўрнатила бошлаган. Бу эса ўз навбатида турли минтақалар ўртасида металлар, тўқимачилик, қимматбаҳо тошлар ва зираворлар каби товарлар алмашинувини осонлаштирган. Биламизки, энг машҳур савдо йўлларидан бири бўлган Буюк ипак йўли асрлар давомида Шарқ ва Ғарб ўртасидаги асосий савдо алоқасига айланиб кетган.

Дарҳақиқат, логистика сектори Марказий Осиё давлатлари иқтисодиётининг ўсиши ва ушбу иқтисодиёт асосидаги минтақавий ҳамкорлик билан узвий боғлиқдир. Логистика инфратузилмасининг ўсиши Марказий Осиё давлатлари иқтисодиётига таъсир қилади ва Марказий Осиё мамлакатлари ўртасидаги иқтисодий ҳамкорликни ривожлантиради. Логистика инфратузилмасига сармоя киритиш бандлик имкониятларини яратади ва иқтисодий ҳамкорлик учун муҳим бўлган товарлар ҳамда хизматларнинг трансчегаравий савдосини осонлаштиради. Худди шундай, Марказий Осиёнинг логистика инфратузилмаси ва ички транспорт йўналишлари ҳеч қачон денгиз транспорти билан рақобатлаша олмайди. Бироқ, мамлакатлар бутун Евроосиёнинг чорраҳасида жойлашганлиги сабабли, улар ўзларининг аҳамиятини топа оладилар.

Марказий Осиё давлатлари иқтисодига дастлабки назар ташлайдиган бўлсак, денгизга чиқиш имконияти йўқлиги юк ва одамларни ташиш учун катта “харажат юкини” [2] келтириб чиқаради. Масалан, Марказий Осиёнинг исталган шаҳридан Шанхайга контейнер жўнатиш, уни Польша ёки Туркиядан жўнатишдан беш баравар қимматга тушади[3]. 1990-йиллар бошида Марказий Осиёда режалаштирилган иқтисодиётдан бозор иқтисодиётига ўтиш қийин кечди [4], у 1990-йиллардаги ўтиш давридаги Германия тажрибасига жуда ўхшаб кетади. [5]

1999-2014-йилларда Марказий Осиё иқтисодиёти асосан ресурс кўпайиши томонидан бошқарилган. [6] Помфрет фикрича, Марказий Осиёни товар экспорти ва пул ўтказмаларига қарамликдан халос қилиш ва очиқ, диверсификатцияланган иқтисодиётга ўтиш фақат институтционал ўзгаришлар орқали мумкин. Марказий Осиё ҳозирда Россия Федератцияси, Хитой, Европа Иттифоқи, АҚШ, Япония, Ҳиндистон, Эрон ва Туркияни ўз ичига олган йирик давлатлар ва минтақалар ўртасида “энергетика геосиёсати” бўйича “қаттиқ ўйин” марказида турибди. “Бир камар ва йўл” ташаббуси Қозоғистон учун марказий логистика марказига

айланиш учун улкан имкониятдир”, аммо, "бу прогноз 2022 йил бошидан бери кучайган геосиёсий хавф-хатарлар билан хиралашган". [2]

Логистика Марказий Осиёда иқтисодий ҳамкорликни ривожлантириш учун муҳим аҳамиятга эгадир. Дарҳақиқат, самарали логистика инфратузилмаси ва хизматларига сармоя киритиш транспорт харажатларини пасайтириш, минтақалараро савдони ошириш ва минтақавий интегратцияни оширишга олиб келиши мумкин. Марказий Осиё давлатлари минтақада иқтисодий ўсиш ва ривожланишни таъминлаш учун логистика инфратузилмаси ва хизматларига сармоя киритиши керак, деб ҳисоблаймиз.

Хулоса қилиб шуни айтиш керакки, Жаҳон банки томонидан тайёрланган Логистика самарадорлиги индексида 2023 йилда Ўзбекистон 88-ўринни эгаллади. Ўзбекистон 2018 йилдаги аввалги ҳисоботга нисбатан ўз кўрсаткичларини 11 поғонага яхшилаган. Ўзбекистон янги индексда 2,6 балл (5 баллдан) тўплади.[8]

Демак, логистика Марказий Осиёда интеграция ва иқтисодий ҳамкорлик, савдо тўсиқларини камайтириш учун муҳим аҳамиятга эга ҳисобланади. Логистика Марказий Осиёда иқтисодий ривожланиш ва барқарор ўсиш учун асос яратади. Шунинг учун унинг иқтисодий ўзаро таьсирини ривожлантиришдаги функциясини ўрганиш бугунги кунда олимлар учун муҳим тадқиқот обьекти ҳисобланади.

ЛИТЕРАТУРА:

1. Шавкат Мирзиёев транспорт ва логистика соҳасидаги камчиликларни санаб, қатор топшириқлар берди// https://daryo.uz/k/2022/09/28/shavkat-mirziyoyev-transport-va-logistika-sohasidagi-kamchiliklarni-sanab-qator-topshiriqlar-berdi
2. Raballand, G. Determinants of the negative impact of being landlocked on trade: An empirical investigation through the Central Asian Case. Comparative Economic Studies, 45(4), **. (2003).** 520–536. https://doi.org/10.1057/palgrave.ces.8100031
3. Trade.gov. Kazakhstan - Transport and Logistics. International Trade Administration. Retrieved March 18, 2024, from https://www.trade.gov/country-commercial-guides/kazakhstan-transport-and-logistics
4. Tashmatov, A., Aknazarov, F., Juraev, A., Khusanov, R., Kadyrkulov, K. D., Kalchayev, K., & Amirov, B. Food policy reforms for sustainable agricultural development in Uzbekistan, the Kyrgyz Republic, and Tajikistan. **(2000).** Food Policy, 25(6), 719–732. https://doi.org/10.1016/S0306-9192(00)00034-8
5. Brauweiler, H.-C., & Yerimpasheva, A. (2022). Challenges and opportunities to develop Kazakhstani logistics projects within the BRI. Discourses in Social Market Economy. Retrieved March 18, 2024, from https://ideas.repec.org/p/zbw/opodis/20222.html
6. Pomfret, R. (2021). Central Asian Economies: Thirty Years After Dissolution of the Soviet Union. Comparative Economic Studies, 63(4), 537–556. https://doi.org/10.1057/s41294-021-00166-z
7. Месалух С.А. Logistics history: origin and development. <https://www.mecalux.com/blog/logistics-history-origin> [был доступен 04.04.2024
8. Ўзбекистонда логистика саноатини рақамлаштиришда ахборот технологияларининг ўрни қандай?// https://aniq.uz/yangiliklar/uzbekistonda-logistika-sanoatini-raqamlashtirishda-axborot-texnologiyalarining-urni-qanday

https://doi.org/10.5281/zenodo.18811149

УЧЕТ РЕКЛАМНЫХ И МАРКЕТИНГОВЫХ РАСХОДОВ НА ПРЕДПРИЯТИЯХ: АНАЛИЗ И ПРАКТИЧЕСКИЕ ПОДХОДЫ

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Резюме. *Маркетинговые затраты очень важны для любой компании. Недостаточно просто производить продукт. Необходимо также продвигать продукт, устанавливать связь с клиентами и создавать имидж бренда. Пример Apple и Samsung показывает, что правильное планирование бюджета дает компании конкурентное преимущество и увеличивает выручку. Маркетинговые затраты охватывают все этапы, от разработки продукта до продаж. Каждая статья расходов должна соответствовать цели. Маркетинг важен как для продаж, так и для понимания поведения клиентов и построения долгосрочных отношений. Эффективное планирование маркетинга формирует будущую стратегию компании и повышает доверие клиентов. Поэтому каждое предприятие должно тщательно планировать и контролировать маркетинговые затраты.*

Ключевые слова: *маркетинговые затраты, маркетинговый бюджет, стратегия продаж, конкурентное преимущество, эффективное распределение ресурсов*

ACCOUNTING OF ADVERTISING AND MARKETING EXPENSES AT ENTERPRISES: ANALYSIS AND PRACTICAL APPROACHES

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Summary. *Marketing expenses are very important for every company. Making a product is not enough. It must be promoted, customers need to be reached, and the brand's image should be built. The experience of Apple and Samsung shows that proper budget planning helps companies stay competitive and increase profits. Marketing expenses cover all stages, from production to sales. Every dollar spent should be useful. Marketing is not only for sales but also to understand customer behavior and build long-term relationships. Effective marketing planning helps shape the company's strategy and strengthens customer trust. Therefore, every company should carefully plan and monitor its marketing expenses to succeed and maintain a strong position in the market.*

Keywords: *marketing costs, marketing budget, sales strategy, competitive advantage, efficient allocation of resources*

Введение.

Объектом исследования являются маркетинговые и рекламные затраты, используемые предприятиями. Эти затраты играют важную роль в узнаваемости предприятия на рынке, увеличении продаж и поддержании его конкурентоспособности. **Предметом исследования**

является планирование маркетинговых и рекламных затрат, их учет и особенности применения в бухгалтерском учете.

Основная цель исследования – изучить значение маркетинговых и рекламных затрат на предприятиях, проанализировать, как эти затраты оцениваются и учитываются в бухгалтерском учете, и одновременно показать влияние надлежащего регулирования затрат на финансовые результаты.

Задачи исследования следующие:

- изучение содержания и сущности маркетинговых и рекламных затрат;
- анализ механизмов определения маркетинговых затрат и контроля за ними;
- изучение планирования маркетинговых затрат на примере компаний Apple и Samsung;
- изучение особенностей оценки маркетинговых и рекламных затрат и их отражения в бухгалтерском учете;
- представление примеров практической значимости для предприятий.

Научная новизна исследования связана с подходом к маркетинговым и рекламным издержкам как с управленческой, так и с финансовой точки зрения, а также с анализом этих областей во взаимосвязи.

Научная и практическая значимость исследования заключается в том, что полученные результаты могут быть использованы для формирования маркетинговых бюджетов на предприятиях, учета затрат и более точного анализа финансовых результатов.

Методология исследования

В исследовании в качестве новаторского подхода был использован метод сравнительного анализа. С помощью этого метода был проведен сравнительный анализ маркетинговых и рекламных затрат компаний Apple и Samsung, выявлены сходства и различия в планировании затрат и формировании маркетингового бюджета. Применение сравнительного анализа на практике помогает в принятии будущих управленческих решений. [5]

Кроме того, был применен метод анализа нормативно-правовых документов. Этот метод исследовал документы, подготовленные в соответствии с Национальными правилами бухгалтерского учета, и изучалась нормативно-правовая основа отражения маркетинговых и рекламных затрат в бухгалтерском учете. [9]

Сложность и неопределенность принципов формирования маркетинговых затрат на предприятиях требуют четкого понимания социально-экономических и политических процессов в стране, непрерывного сбора данных предприятием, аналитической обработки и обратной связи с целевыми сегментами. Решения об утверждении маркетингового бюджета должны основываться на стратегии компании и мероприятиях по ее достижению. [3]

На основе теории и практики исследования компании смогут логично и эффективно создавать бюджет маркетинговой деятельности. Планирование маркетингового бюджета является жизненно важным процессом для компании. Без него невозможно получить прибыль, а следовательно, и само существование компании. Маркетинговый бюджет — это финансовый план, в котором перечислены затраты, доходы и прибыль компании, связанные с ее маркетинговой деятельностью. Маркетинговый бюджет определяет объем ресурсов, выделяемых на анализ поведения потребителей и разработку мер по увеличению числа клиентов компании. [2]

Как правило, эти мероприятия направлены на улучшение имиджа бренда или информирование потенциальных потребителей о преимуществах предлагаемых продуктов. Маркетинг играет ключевую роль в продажах, поэтому необходимо иметь бюджет, соответствующий условиям компании. По этой причине необходимо количественно оценить бюджеты предыдущих периодов с точки зрения полученной прибыльности. Маркетинговый бюджет формируется на этапе корпоративного планирования. Он является частью общего

бизнес-плана. Средства в основном выделяются на мероприятия, которые обеспечат максимальную прибыль. [13]

Многие эксперты отмечают, что 10% прибыли — это идеальный процент для расходов на маркетинг. Конечно, эта цифра зависит от многих факторов. Однако многие компании (особенно те, чей годовой доход превышает 5 миллиардов долларов) отклоняются от правила 10%. Они тратят больше на продвижение. Это определяется их показателями и долей рынка. Согласно исследованиям, компании тратят в среднем около 12% своего годового дохода на маркетинг. Исследования показали, что крупные компании (с годовым доходом более 5 миллиардов долларов) тратят 13% своей выручки на маркетинг, в то время как малые компании (с доходом от 250 до 500 миллионов долларов) тратят около 10% на продвижение.

Многие компании не учитывают значительные затраты на маркетинговые коммуникации. В данной работе представлены обоснованные аргументы в пользу того, что маркетинг является основной основой успешного предприятия. Рассмотрены тенденции, непосредственно влияющие на размер маркетингового бюджета и определяющие его. Проанализированы мировые подходы и принципы структурного распределения маркетинговых затрат. Цель данного исследования – разработка способов повышения эффективности маркетинговой деятельности предприятия в современных рыночных условиях. Результаты исследования могут быть использованы предприятиями для повышения эффективности использования маркетинговой деятельности, тем самым повышая конкурентоспособность местных предприятий и улучшая экономическое положение их стран. [11]

Бюджет продаж является основой для формирования маркетингового бюджета, который, в свою очередь, состоит из ряда бюджетов. Однако последовательность формирования бюджетов может быть различной, что определяется принципами их построения на конкретном предприятии. Обычно выделяют следующие основные принципы:

– «сверху вниз»;

– «снизу вверх».

Современная рыночная экономика отличается высокой конкуренцией. Для поддержания конкурентного преимущества производители должны не только удовлетворять все потребности потребителей, но и предвосхищать их.

Иногда даже самая незначительная характеристика продукта, например, тип чехла для персонального компьютера, может значительно увеличить продажи или оттеснить продукт на периферию рынка товаров и услуг.

Исходя из всего вышесказанного, можно отметить, что производителю важно обращать внимание на желания потребителей и инвестировать не только в производство продукта, но и в ряд исследований, которые помогут определить предпочтения потребителей, а также в мероприятия, которые помогут создать те желания потребителей, на которые ориентируется производитель.

Эта концепция возникла со временем, в процессе, который происходил по мере развития рыночных отношений и конкуренции. Постепенно начали вырисовываться определенные закономерности, которые, в свою очередь, привели к появлению определенных правил, и эти правила начали развиваться в набор правил. В результате естественного эволюционного процесса в начале двадцатого века возникло понятие маркетинга (маркетинг: рынок, приобретать - обладать), то есть науки, описывающей философию рынка, тактику действий и образ мышления участников рынка. [10]

Маркетинг — это искусство и наука привлечения, удержания и увеличения потребителей путем правильного выбора целевого рынка, формирования у покупателя убеждения, что он представляет собой наивысшую ценность для компании, а также организованный и целенаправленный процесс выявления проблем потребителей и регулирования рыночной деятельности. [15]

Маркетинг также влияет на этап закупки сырья, поскольку важно понимать приоритеты клиента, как он отреагирует на использование некачественного сырья и каков будет спрос на определенный вид упаковки для будущего продукта. Иными словами, этот этап производства не менее важен, чем само понятие, поскольку современные потребители также хорошо осведомлены о воздействии определенных материалов и веществ на их здоровье и окружающую среду. [12]

Параллельно со следующим этапом (производство продукта) важно организовать рекламную кампанию для продвижения продукта, поскольку неизвестные продукты без отличительных особенностей или продукты с небольшой уникальностью, даже визуально, не будут потребляться без предварительного знакомства. Однако, если продукт эффективно рекламируется, потребитель убедится в его целесообразности покупки. Успех в эпоху высоких технологий часто достигается не отдельными, блестящими идеями, а теми, кто применяет систематический и комплексный подход к рекламе и брендингу. [14]

Для целей бухгалтерского учета организации к рекламным расходам относятся следующие виды расходов:

- подготовка, публикация и распространение иллюстрированных прайс-листов, каталогов, брошюр, альбомов, проспектов, плакатов, рекламных открыток и т. д.;
- подготовка, производство и распространение оригинальных и фирменных сумок, упаковки, рекламных сувениров и образцов производимой продукции;
- печатная реклама, радио- и телепередачи, т. е. через средства массовой информации;
- наружная и световая реклама;
- приобретение, производство и демонстрация рекламных фильмов, видеороликов и слайдов и тому подобного;
- производство рекламных щитов и вывесок;
- участие в выставках, демонстрациях и ярмарках;
- оформление витрин, торговых павильонов, демонстрационных залов и выставочных площадок;
- продажа по сниженной цене товаров, полностью или частично утративших свои первоначальные качества при размещении в витринах;
- приобретение (производство) и распространение призов, вручаемых победителям лотерей в ходе массовых рекламных кампаний;
- на проведение рекламных мероприятий, связанных с деятельностью организации;
- прочие рекламные расходы.

Для признания расходов в бухгалтерском учете необходимо соблюдение ряда условий, установленных пунктом 16 ПБУ 10/99:

- расходы понесены в соответствии с конкретным договором согласно требованиям законодательных и нормативных актов;
- сумма расходов должна быть определена;
- расходы возникают в результате конкретной операции, которая приведет к снижению экономической выгоды организации.

Когда организация передает актив или нет неопределенности относительно передачи актива, существует уверенность в том, что конкретная операция уменьшит экономическую выгоду организации.

Если какое-либо из этих условий не выполняется, любые расходы, понесенные организацией, признаются дебиторской задолженностью в бухгалтерской отчетности организации.

Для признания рекламных расходов как расходов, связанных с обычной деятельностью, необходимо иметь документы, подтверждающие выполнение рекламных работ и услуг:

- Договор на оказание рекламных услуг;
- Протокол об утверждении цены на рекламные услуги;
- Лицензия на наружную рекламу;

- Паспорт рекламного пространства;
- Утвержденный дизайн-проект;
- Свидетельство о приемке выполненных работ (оказанных услуг);
- Счета-фактуры от рекламного агентства;
- Документы, подтверждающие оплату рекламных услуг;
- Запрос на передачу материалов третьим лицам и счет-фактура;
- Свидетельство о списании товаров (готовой продукции);
- Свидетельство о скидке на товары.

Сохранение печатных изданий, содержащих опубликованную рекламу, а также аудио- или видеокассет с записями рекламы поможет разрешить споры с налоговыми органами во время проверок. [4]

Расходы на рекламу, отраженные в бухгалтерском учете как дебет счета № 711 «Коммерческие расходы», списываются за счет себестоимости проданных товаров либо полностью, либо пропорционально объему проданных товаров, в зависимости от метода списания коммерческих расходов, указанного в учетной политике организации. [6]

Согласно статье 108 Налогового кодекса Азербайджанской Республики, все расходы, связанные с получением дохода, вычитаются из дохода. Поэтому необходимо подтвердить, что коммерческие расходы (рекламные, представительские, комиссионные и т. д.) действительно связаны с получением дохода. После подтверждения они могут быть отнесены к расходам, уменьшающим доход, и уплаченный с них НДС может быть зачтен. [7]

Промышленные, сельскохозяйственные и другие производственные предприятия используют этот счет для отражения расходов, связанных с продажей продукции, включая следующие:

Расходы на упаковку и упаковку продукции на складах готовой продукции, за исключением случаев, когда договор предусматривает продажу продукции без упаковки или стоимость упаковки оплачивается дополнительно к покупной цене продукции. Если продукция упаковывается в цехах (в соответствии с установленным технологическим процессом) перед отправкой на склад готовой продукции, то затраты на упаковку и фасовку включаются в себестоимость производства продукции (в соответствующей продукции или в составе комбинированной продукции, если упаковка производится заранее и отдельно от производства продукции);

затраты на доставку продукции до станции отправления (перевалочного пункта), погрузку на железнодорожные вагоны, суда, грузовики и другие транспортные средства;

комиссионные сборы (удержания), уплачиваемые торговым и другим посредническим организациям в соответствии с установленными нормами и договорами купли-продажи продукции предприятия на комиссионной основе;

Скидки на организованный оборот при продаже продукции в пути от предприятий-поставщиков к организациям снабжения и сбыта, с участием или без участия в расчетах, а также комиссионные, выплачиваемые торговым, снабженческим или сбытовым организациям за продажу продукции, которую предприятия не могут продать и поэтому выставляют на продажу на комиссионной основе;

Содержание складских помещений для продукции в пунктах продажи, заработная плата продавцов (для сельскохозяйственных предприятий);

Расходы на рекламу;

Расходы на погрузку, разгрузку и транспортировку ремонтных материалов (на ремонтно-технических предприятиях);

Суммы, вычитаемые на содержание пунктов технического обмена на ремонтно-технических предприятиях;

Прочие расходы, связанные с распределением продукции, например, расходы на специальные анализы продукции, проводимые при выпуске, и т. д.

Эти расходы добавляются к себестоимости отдельных видов продукции на основании первичных документов. Если себестоимость продукции не может быть определена на основании первичных документов, она распределяется между отдельными видами продукции пропорционально весу, объему, количеству или себестоимости продукции.

Коммерческие расходы на потребительские товары, промышленные и технические товары, полуфабрикаты и полуфабрикаты, изготовленные из производственных отходов, а также непродовольственные потребительские товары, изготовленные из отечественного сырья, включаются только в раздел, связанный с продажами. [8]

Сравнительный анализ маркетинговых расходов Apple и Samsung

Не секрет, что Apple тратит много денег на маркетинг. Только в 2023 году Apple выделила более 1,7 миллиарда долларов на глобальную рекламу, что составляет более 1,4 миллиарда долларов в предыдущем году. Samsung, также являясь крупным транжирой, инвестировала около 1,3 миллиарда долларов за тот же период. На бумаге Apple тратит примерно на 30% больше, чем Samsung.

Но большие расходы не означают автоматически лучшие результаты. Важно то, как используются эти деньги. Apple, как правило, концентрирует свой бюджет на высокоэффективных, глобально согласованных кампаниях, которые часто фокусируются на запуске продуктов. Samsung, с другой стороны, распределяет свои инвестиции по региональным рынкам, партнерству с операторами и цифровой рекламе, ориентированной на результат.

Таблица 1. Сравнение маркетинговых (рекламных) расходов Apple и Samsung в 2023 году

Компания	**Рекламные расходы**	**Ключевые каналы**	**Основные направления кампаний**
Apple	1,7 млрд долларов США	Телевидение, YouTube, Наружная реклама, Розничная торговля	эмоции, простота, образ жизни
Samsung	1,3 млрд долларов США	Цифровые каналы, Социальные сети, Телевидение, Спонсорство	функции, инновации, конкуренция

Источник: https://www.alibaba.com/product-insights/apple-vs-samsung-ads-are-apples-ads-really-more-effective-or-just-bigger-budget.html?utm_source

Научная новизна исследования

Помимо обобщения теоретических подходов, в исследовании проанализированы маркетинговые и рекламные издержки. В качестве научной новизны исследования подчеркиваются следующие аспекты:

- подход к маркетинговым и рекламным издержкам не только с точки зрения финансового учета, но и как к ключевому фактору управленческого учета;
- важность предварительного обсуждения, регистрации и анализа влияния маркетинговых издержек на финансовые результаты предприятия;
- объяснение количественного показателя и распределения маркетинговых (рекламных) издержек по характеристикам на примере Apple и Samsung;
- демонстрация важности учета их распределения при оценке маркетинговых издержек наряду с объемом издержек.

Заключение

На основании проведенного исследования установлено, что расходы на маркетинг и рекламу являются одним из основных инструментов управления, напрямую влияющих не

только на сбытовую деятельность предприятия, но и на его финансовые результаты и долгосрочное стратегическое положение. Исследование показывает, что хаотичный и неконтролируемый подход к этим расходам приводит к неэффективному использованию финансовых ресурсов, в то время как правильно спланированные и учтенные маркетинговые расходы способствуют укреплению конкурентного преимущества предприятия.

С точки зрения бухгалтерского учета анализ выявил, что правильное признание, документирование и отражение расходов на маркетинг и рекламу на счете № 711 «Коммерческие расходы» повышает прозрачность финансовой отчетности предприятия и минимизирует налоговые риски. При этом особое значение имеет обоснование связи этих расходов с формированием доходов в соответствии с требованиями Налогового кодекса Азербайджанской Республики.

Сравнительный анализ Apple и Samsung показывает, что их структурное распределение и использование так же важны, как и объем маркетинговых расходов. В то время как Apple предпочитает кампании с более глобальным и эмоциональным воздействием, Samsung применяет стратегию, адаптированную к региональным рынкам и ориентированную на цифровые каналы. Эта разница доказывает, что целенаправленный и стратегический подход, а не высокие затраты, приводит к более эффективным результатам.

На основе результатов исследования можно сделать вывод, что предприятиям следует рассматривать маркетинговые издержки не только как текущие расходы, но и как инвестиции, приносящие будущую экономическую выгоду. Увязка маркетингового бюджета с управленческим учетом, измерение эффективности затрат и сравнительный анализ с финансовыми результатами являются необходимыми условиями для современных предприятий.

Следовательно, плановое, регулирующее и аналитическое управление маркетинговыми и рекламными издержками укрепляет финансовую стабильность предприятия, повышает его рыночные позиции и создает реальные возможности для устойчивого развития.

ЛИТЕРАТУРА

1. Адебола, С. А., и Окафор, К. И. (2025). Влияние маркетинговых расходов на финансовые показатели: межотраслевой анализ с использованием метода учета затрат на основе видов деятельности (ABC). Международный журнал исследований и научных инноваций, 12 (1), 45–55. https://rsisinternational.org/journals/ijrsi/articles/the-impact-of-marketing-expenditures-on-financial-performance-a-cross-industry-analysis-using-activity-based-costing-abc/
2. Ахмед, Р., и Хан, М. С. (2024). Анализ затрат на маркетинговые кампании: методы и последствия для финансовой отчетности. Журнал бухгалтерского учета и маркетинга, 13(2), 1–12. https://www.hilarispublisher.com/open-access/cost-analysis-of-marketing-campaigns-methods-and-implications-for-financial-reporting.pdf
3. Демирчи, Э., и Эрдем, К. (2023). Влияние расходов на маркетинг и НИОКР на прибыльность фирмы и доходность акций: данные Стамбульской фондовой биржи. Международный журнал организационного лидерства и анализа изменений, 5(2). https://ijocta.org/index.php/files/article/view/1238
4. Хуан, С., Ли, К., и Чжан, Ю. (2024). Конкуренция в рекламе и дискреционное раскрытие информации. Журнал бухгалтерского учета и экономики, 77(2), 101597. https://doi.org/10.1016/j.jacceco.2023.101597
5. Клистик, Т., Валаскова, К., Ника, Е., и Ковацова, М. (2025). Детерминанты финансовых показателей в рекламных и маркетинговых компаниях. Журнал управления рисками и финансами, 18(3), 141. https://doi.org/10.3390/jrfm18030141
6. Курбиев, Б. А. (2015). Рекламные расходы для целей бухгалтерского учета. Наука Время, 1, 298–305.

7. Muhasib.az. (2018, 16 августа). Коммерческие расходы. Бухгалтерский учет. [Получено с https://www.muhasib.az/article.php?cat=2&n=830](https://www.muhasib.az/article.php?cat=2&n=830
8. Счет 43 «Коммерческие расходы». (без даты). Получено с https://www.consultant.ru/document/cons_doc_LAW_28762/6a1f6dc5cad98d38501f0fd7dada06a1e7226290/
9. Шрайбер, С. (2018). Учет рекламных расходов — различия и сходства между US GAAP, IAS/IFRS и немецким Торговым кодексом. Журнал европейской экономики, 4(3), 333–350. https://jeej.wunu.edu.ua/index.php/enjee/article/view/1092
10. Смит, Дж., и Браун, Л. (2023). Влияние маркетинговых расходов на финансовые показатели: межотраслевой анализ с использованием метода учета затрат на основе видов деятельности (ABC). Международный журнал исследований в области социальных наук и менеджмента, 10(2), 45–59. https://rsisinternational.org/journals/ijrsi/articles/the-impact-of-marketing-expenditures-on-financial-performance-a-cross-industry-analysis-using-activity-based-costing-abc/
11. Тран Тхи Тхань Тхуи и Климова, Е. (2022). Оценка маркетинговых расходов на примере компаний Apple и Samsung. Технологический аудит и производственные ресурсы, 4(4/66), 14–17.
12. Йылдыз, Б., и Айдин, Н. (2024). Влияние маркетинговых расходов фирм, работающих на Стамбульской фондовой бирже, на показатели деятельности компании. Турецкий журнал маркетинга, 9(1), 1–18. https://www.tujom.org/index.php/1/article/view/198
13. Узбек, В., Йылдырым Кутбай, А., и Акар, К. (2024). Влияние маркетинговых расходов фирм, работающих на Стамбульской фондовой бирже, на показатели деятельности компании. Турецкий журнал маркетинга, 9(3), 83–96. https://doi.org/10.30685/tujom.v9i3.198
14. Халевинская, А. Б. (2016). Данные о маркетинговых расходах. Сибирский научный вестник, 4(23), 40–50.
15. Замула, И., Садовска, И., Гнатьева, Т., и Ткачук, Г. (2024). Международный опыт учета маркетинговых расходов. Украинский журнал прикладной экономики и технологий, 3, 47–51. https://doi.org/10.36887/2415-8453-2024-3-8

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AZƏRBAYCAN RESPUBLİKASI ELM VƏ TƏHSİL NAZİRLİYİ İQTİSADİYYAT İNSTİTUTUNUN

NƏCƏFLİ SVETLANA XALİD
Böyük elmi işçi

Azərbaycan iqtisadiyyatında regionların strukturunun transfarmasiyası

Xülasə. *Məqalədə, Azərbaycan iqtisadiyyatında regionların strukturunun transformasiyası ölkənin dayanıqlı inkişaf strategiyasının əsas istiqamətlərindən biridir. Bu proses regionlarda iqtisadi fəaliyyətin şaxələndirilməsi, qeyri-neft sektorunun inkişafı, infrastrukturun modernləşdirilməsi və məşğulluğun artırılması ilə xarakterizə olunur. Dövlət proqramları və investisiya təşviqləri nəticəsində kənd təsərrüfatı, sənaye, logistika və turizm sahələri regionlarda daha fəal inkişaf etməyə başlamışdır. Araşdırmada, regional struktur transformasiyası iqtisadi tarazlığın təmin olunmasına, sosial rifahın yüksəldilməsinə və paytaxtla regionlar arasında inkişaf fərqlərinin azaldılmasına baxılmışdır.*

Açar sözlər: *regional inkişaf, iqtisadi transformasiya, qeyri-neft sektoru, struktur dəyişiklikləri, regional iqtisadiyyat, dayanıqlı inkişaf, dövlət proqramları.*

TRANSFORMATION OF THE STRUCTURE OF REGIONS IN THE AZERBAIJANI ECONOMY

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Resume. *The article states that the transformation of the structure of regions in the Azerbaijani economy is one of the main directions of the country's sustainable development strategy. This process is characterized by the diversification of economic activity in the regions, the development of the non-oil sector, the modernization of infrastructure and the increase in employment. As a result of state programs and investment incentives, the agricultural, industrial, logistics and tourism sectors have begun to develop more actively in the regions. Regional structural transformation serves to ensure economic balance, improve social welfare and reduce development gaps between the capital and the regions.*

Keywords: *regional development, economic transformation, non-oil sector, structural changes, regional economy, sustainable development, state programs.*

ТРАНСФОРМАЦИЯ СТРУКТУРЫ РЕГИОНОВ В ЭКОНОМИКЕ АЗЕРБАЙДЖАНА

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Резюме. *В статье утверждается, что трансформация структуры регионов в азербайджанской экономике является одним из главных направлений стратегии устойчивого развития страны. Этот процесс характеризуется диверсификацией экономической деятельности в регионах, развитием несырьевого сектора, модернизацией инфраструктуры*

и увеличением занятости. В результате государственных программ и инвестиционных стимулов в регионах стали более активно развиваться такие сектора, как сельское хозяйство, промышленность, логистика и туризм. Региональная структурная трансформация служит обеспечению экономического баланса, повышению социального благосостояния и сокращению разрыва в развитии между столицей и регионами.

Ключевые слова: *региональное развитие, экономическая трансформация, не нефтяной сектор, структурные изменения, региональная экономика, устойчивое развитие, государственные программы.*

Giriş: Qloballaşma və dünya iqtisadiyyatında baş verən sürətli dəyişikliklər milli iqtisadiyyatların, xüsusilə də regionların inkişaf modelinin yenidən formalaşdırılmasını zəruri edir. Azərbaycan Respublikasında regionların sosial-iqtisadi inkişafı dövlət siyasətinin prioritet istiqamətlərindən biridir. Bu baxımdan regionların iqtisadi strukturunun transformasiyası dayanıqlı inkişafın təmin olunmasında mühüm rol oynayır.

Regionların iqtisadi strukturunun mahiyyəti: Regionların iqtisadi strukturu müəyyən ərazi daxilində fəaliyyət göstərən sahələrin nisbəti, istehsalın təşkili forması və resurslardan istifadə səviyyəsi ilə xarakterizə olunur. Struktur transformasiyası isə ənənəvi sahələrdən daha yüksək əlavə dəyər yaradan, rəqabətqabiliyyətli və innovativ sahələrə keçidi ifadə edir. Bu proses iqtisadi artımın keyfiyyətinin yüksəldilməsinə xidmət edir.

Azərbaycan iqtisadiyyatında regional struktur transformasiyası bir neçə əsas istiqamət üzrə həyata keçirilir:

*Qeyri-neft sektorunun inkişafı: Neft gəlirlərindən asılılığın azaldılması məqsədilə kənd təsərrüfatı, emal sənayesi, turizm və xidmət sahələri regionlarda prioritet istiqamət kimi inkişaf etdirilir.

*Sənayeləşmə və sənaye parkları: Regionlarda sənaye zonalarının və aqroparkların yaradılması istehsalın genişlənməsinə və məşğulluğun artmasına şərait yaradır.

*İnfrastrukturun yenilənməsi:Nəqliyyat,enerji və kommunikasiya infrastrukturunun modernləşdirilməsi regionların investisiya cəlbediciliyini artırır.

*İnsan kapitalının inkişafı: Təhsil, peşə hazırlığı və məşğulluq proqramları, "Azərbaycan Respublikası regionlarının sosial-iqtisadi inkişafı Dövlət Proqramları regionlarda əmək resurslarının keyfiyyətini yüksəldir.

Dövlət proqramlarının rolu: Regionların struktur transformasiyasında həlledici rol oynayır. Bu proqramlar çərçivəsində investisiya mühitinin yaxşılaşdırılması, sahibkarlığın dəstəklənməsi və yerli istehsalın stimullaşdırılması həyata keçirilir.

Cədvəl 1.

İqtisadi rayonlarda kçik və orta sahibkarlıq subyektlərinin payı (%)

	İqtisadi rayonlar	Kiçik sahibkarlıq subyekt.-nin payı(%)	Orta sahibkarlıq payı (%) |
	Азербайджанский Республика	99,8	100
1	город Баку	74,2	69,5
2	Нахчыванская АР	1,8	1,8
3	Абшерон-Хызы	6,8	6,4
4	Горный Ширван	1,8	1,3
5	Гянджа-Дашкасан	2,1	2,6
6	Карабах	1,9	2,4
7	Газах-Товуз	1,8	2,0
8	Губа-Хачмаз	2,1	2,6
9	Ленкорань-Астара	1,8	2,1
10	Центральный Аран	2,1	2,5
11	Миль-Мугань	1,4	1,8

12	Шеки-Загата	2,1	3,1
13	Восточный Зангезур	0,4	0,5
14	Ширван-Сальян	1,2	2,1

Mənbə: cədvəl məllif tərəfindən Azərbaycan Respublikası DSK-nin materialları əsasında tərtib edilmişdir. Bakı 2025.

Cədvəl 1-də göstərildiyi kimi, Azərbaycanda kiçik subyektlər ölkədə fəaliyyət göstərən bütün biznes subyektlərinin çox böyük hissəsini təşkil edir (ölkə üzrə ~99,6 %). Kiçik sahibkarlıq subyektlərində ən böyük pay Bakı şəhərinə məxsusdur- 74,2 %-i burada cəmləşib. Daha sonra Abşeron-Xızı (6,8 %), Mərkəzi Aran (2,1 %) və Şəki-Zaqatala (2,1 %) iqtisadi rayonlarıdır Azərbaycanda orta subyektlər də ölkədə fəaliyyət göstərən bütün biznes subyektlərinin çox böyük hissəsini təşkil edir (ölkə üzrə ~100 %). Orta sahibkarlıq subyektləri də əsasən Bakıda cəmləşib (~69,5 %), Abşeron-Xızı (6,4 %), Gəncə-Daşkəsən (2,6 %) və Quba-Xaçmaz (2,6 %) bölgələri ikinci və üçüncü ən çox orta sahibkarlıq subyektinə malik bölgələrdir. Onların bir çoxu ticarət, kənd təsərrüfatı, tikinti və digər xidmət sahələrində fəaliyyət göstərir.

N**əticələr və perspektivlər**

Regionların iqtisadi strukturunun transformasiyası nəticəsində aşağıdakı dəyişikliklər baş vermişdir:

- Regionlararası iqtisadi fərqlərin azaldılması, bəzi bölgələrdə isə sənaye və xidmət sektorlarının payının artması.
- Yeni iş yerlərinin yaradılması və əhalinin sosial vəziyyətinin yaxşılaşması.
- Qlobal iqtisadi trendlərə uyğun olaraq, regionların iqtisadiyyatının diversifikasiyası və dayanıqlılığının artırılması.

Nəticə: Aparılan islahatlar regionlarda iqtisadi aktivliyin artmasına, yeni iş yerlərinin açılmasına və əhalinin gəlir səviyyəsinin yüksəlməsinə səbəb olmuşdur. Eyni zamanda, regionlarla paytaxt arasında sosial-iqtisadi fərqlərin tədricən azalması müşahidə olunur. Bu isə ölkə üzrə balanslı və inklüziv inkişafın təmin edilməsinə şərait yaradır. Azərbaycan iqtisadiyyatında regionların strukturunun transformasiyası uzunmüddətli və kompleks bir prosesdir. Bu prosesin uğurla davam etdirilməsi regional resurslardan səmərəli istifadəni, iqtisadi şaxələndirməni və sosial rifahın yüksəldilməsini təmin edir. Gələcəkdə innovasiya, rəqəmsallaşma və "yaşıl iqtisadiyyat" prinsiplərinin regionlarda tətbiqi struktur transformasiyasını daha da sürətləndirə bilər.

ƏDƏBIYYAT SIYAHIS

1. Azərbaycan Respublika Prezidenti İlham Əliyev (2021). Azərbaycan 2030: sosial-iqtisadi inkişafa dair Milli Prioritetlər. Bakı, 2021.
2. Aliyev, S. (2023) Regionların iqtisadi təhlükəsizliyi və prioritet sahələrin inkişafı.
3. Rauf Rzayev (2024), Azərbaycan iqtisadiyyatının transformasiyası kontekstində bilik iqtisadiyyatı, innovasiya və regional inkişaf dinamikası.
4. Fərhad Rəhmanov, Elçin Süleymanov (2021) Azərbaycan iqtisadiyyatının keçid dövrü, struktur dəyişiklikləri və regionlararası iqtisadi inkişaf detalları.
5. Haciyev, F. (2024) , Rəqəmsal iqtisadiyyatın Azərbaycan iqtisadi strukturunun dəyişməsində rolu (innovasiya və regional struktur dəyişiklikləri).
6. Fuad Məmmədov (2015), Azərbaycan iqtisadiyyatında transformasiya prosesləri, struktur dəyişiklikləri və islahat mərhələləri haqqında bölmələr (transformasiya anlayışı və modelləri).
7. Наджафли С.Х.: Роль инфраструктуры в развитии социальной сферы" XCII Международной научно-практической конференции «Вопросы управления и экономики: современное состояние актуальных проблем». № 2(94).ст.. М., Изд. «Интернаука», Масква 2026.

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ТЕОРЕТИЧЕСКИЕ ОСНОВЫ ЭКОНОМИЧЕСКОЙ ОЦЕНКИ И ИСПОЛЬЗОВАНИЯ ЗЕМЕЛЬНЫХ РЕСУРСОВ РЕГИОНА

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Аннотация: *в данной работе рассматриваются теоретические и методологические подходы к экономической оценке земельных ресурсов на региональном уровне. Автор анализирует роль земли как ключевого фактора производства и объекта социально-экономических отношений. Особое внимание уделяется принципам рационального землепользования, методам определения кадастровой и рыночной стоимости земель, а также факторам, влияющим на эффективность их эксплуатации. В статье обосновывается необходимость совершенствования механизмов государственного регулирования земельного рынка для обеспечения устойчивого развития региональной экономики.*

Ключевые слова: *земельные ресурсы, экономическая оценка, рациональное использование, региональная экономика, земельный кадастр, рыночная стоимость, рентный доход, устойчивое развитие, государственное регулирование.*

Abstract: *This paper examines the theoretical and methodological approaches to the economic assessment of land resources at the regional level. The author analyzes the role of land as a key factor of production and an object of socio-economic relations. Particular attention is paid to the principles of rational land use, methods for determining the cadastral and market value of land, as well as factors influencing the efficiency of its exploitation. The article justifies the need to improve the mechanisms of state regulation of the land market to ensure the sustainable development of the regional economy.*

Keywords: *land resources, economic assessment, rational use, regional economy, land cadastre, market value, rental income, sustainable development, state regulation.*

При рассмотрении вопросов использования земельного потенциала региона можно классифицировать их использования по степени их освоения размещения. В настоящее время во многих научных источниках используется термин «территория интенсивного сельскохозяйственного освоения». Исследуя происхождение этого термина, рассмотрим понятия «территория» и «интенсивное хозяйство». Термин «территория» является одним из фундаментальных понятий в географии и геоэкологии. В работе [56] территория определяется как «ограниченная часть земной поверхности с присущими ей природными и антропогенными свойствами и ресурсами, характеризующаяся протяженностью (площадью) как особым видом «пространственного» ресурса, географическим положением и другими качествами, являющаяся объектом конкретной деятельности или исследования». Алаев Э.Б. рассматривает территорию часто как «атрибут географического пространства, его двухмерный аналог» [8].

Из определения понятия «интенсивное хозяйство», следуеть, что это«получение максимального количества полезной продукции на каждую единицу используемых природных благ с помощью эффективных средств производства и передовых технологий. Оно предполагает наиболее полное извлечение, экономное расходование, и когда это возможно, воспроизводство природных ресурсов, при соблюдении экологических ограничений и обеспечении благоприятных условий жизни людей» [108]. Близким к этому можно считать определение Руновой Т.Г., которая считает интенсивным такое природопользование, которое ведется с ощутимыми вложениями человеческого труда в использование, восстановление, увеличение, улучшение воспроизводственных функций природы [124].

Исходя из этого, можно сформулировать понятие территории интенсивного сельскохозяйственного освоения, как определенного комплекса земельных, водных, минеральных, социально-экономических ресурсов, процесс функционирования которых не ухудшает качество окружающей среды и повышает выпуск продукции без увеличения числа рабочих мест, без распашки новых площадей, без существенного увеличения потребления природных ресурсов.

Согласно этому определению, земля, является одним из важнейших предпосылок и основой сельскохозяйственного производства, соответственно, занимает главное место в развитии и размещение общественного производства и производительных сил. Необходимость интенсивного сельскохозяйственного освоения территорий предопределяет возрастающая численность населения земного шара, что ставит перед человечеством проблему обеспечения людей продовольствием.

По данным ООН, из 14,9 млрд. га суши под пашни, сады и плантации занято менее 10%. Между тем земли, пригодные для обработки, постоянно сокращаются. Такое положение характерно и для Республики Таджикистан. Статистические данные показывают сокращение площади сельскохозяйственных площадей, что наряду с ростом численности населения показывает особую необходимость разработки научно обоснованной государственной стратегии оптимального развития сельского хозяйства для достижения страной продовольственной безопасности.

За последние 15 лет (2001-2015 гг.) посевные площади сельскохозяйственных культур в Хатлонской области Республики Таджикистан сократились на 6,1%, в том числе под такой важной культурой как хлопчатника 37,5%. В Хатлонской области удельные посевные площади за данный период снизились с 0,191 до 0,128 га душу населения. Снижение посевных площадей можно объяснить следующими причинами:

– Выбытие земли из севооборота в связи с засолением и эрозией почвы;
– Незаконный отвод посевных земель под жилищное строительство;
– Неправильное применение агротехнических технологий при возделывании сельскохозяйственной продукции
– Выход из строя значительной части ирригационно-дренажной системы.

Как фактор производства земля является основополагающим элементом в сельском хозяйстве, от качества которой зависит урожайность сельскохозяйственных культур. Функции, которые выполняют земельные ресурсы, проявляются в различных направлениях и отличаются рядом особенностей: «ограниченность используемых земельных ресурсов, свойство земли, как незаменяемый ресурс, учет качественной неоднородность земельных участков, двойственное свойство земля являться предметом и средством труда и вопросы восстановления утерянного плодородия земли».

Ограниченность используемых земельных ресурсов. Земля является таким средств производства, которое невозможно воспроизвести. Размеры сельскохозяйственных угодий ограничены общей земельной площадью. Однако это ограничение относительно т.к. по мере роста научно-технического прогресса, применения современных ирригационно-мелиоративных технологий, электрификации сельского хозяйства, развития производительных сил создаются условия для вовлечения сельскохозяйственный оборот новых земель за счет общих земельных площадей. При этом увеличение сельскохозяйственных площадей невозможно при отсутствии свободных земель, т.е. необходимо принятие во внимание пространственной ограниченности. Ограниченность земли, сокращение сельскохозяйственных угодий и пашни предопределяет необходимость для общества и землепользователей оптимально использовать земельные ресурсы, при этом применять конкретные мероприятия по повышению эффективности их использования.

Вопрос об ограниченности используемых земельных ресурсов тесно связан с их практическим использованием. Здесь необходимо решить задачу определения границ

природно-географических систем. Этот вопрос является наиболее актуальным в рамках проведения географических и экологических исследований. Для установления границ территории природно-географической системы используется системный подход. Необходимо понимать, что большое количество небольших и тесно связанных между собой природных комплексов и являются геосистемой, суть которой лежит именно в плоскости понимания «системы» и «системности». Таким образом, какое-либо влияние или воздействие на часть, один или несколько природных комплексов, в том числе и на их земельные ресурсы, со временем отразится и на других, связанных с затронутыми, комплексах. Результаты воздействия будут напоминать цепную реакцию и могут привести к частичной или полной трансформации цепи природных комплексов. Выше уже отмечался факт сложности определения самих комплексов и результатов воздействия на них, а также необходимость глубокого анализа конкретных условий местности. Системный подход необходимо использовать также и при установлении границ зон природного влияния.

СПИСОК ЛИТЕРАТУРЫ

1. Абдалимов, А.А. Выравнивание условий использования сельскохозяйственных земель / А.А. Абдалимов, К.Ю. Курбонов // Кишоварз. - 2013. - № 2. - С. 54-56.
2. Абдуллаев, Р.А. Развитие ирригации и освоение новых земель в Таджикистане. - Душанбе: Дониш, 1988.- 288 .
3. Абдурахимов, С.Я. Рациональное природопользование в Таджикистане// Аграрная наука. - 2003. - № 6. - С.24-25.
4. Абдусамадов, Г. Переход к рынку: социально-экономические аспекты. Душанбе, 1999. 103-104с.
5. Айгунов А.Д. Программирование развития региона. - М.: Диалог: МГУ, 1997.-С.20.
6. Акрамов З.М. Проблемы хозяйственного освоения пустынных и горно-предгорных территорий. Ташкент, Узбекистан, 1974. с. 17.
7. Актуальные проблемы становления и развития предпринимательства в Таджикистане / ред. Джурабаева Г. - Душанбе: Ирфон, 2003.-94с.
8. Алаев Э.Б. Социально-экономическая география: Понятийно-терминологический словарь. - М.: Мысль, 1983. - 170-178с.

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КОРХОНАҲОИ САНОАТИ ХИМИЯ ВА АҲАМИЯТИ ОНҲО

НУРАЛИЕВ ИСМОИЛ ҲАМЗАЕВИЧ
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Аннотация: *в статье рассматривается роль и значение предприятий химической промышленности в структуре современной национальной экономики. Автор анализирует специфику производственных процессов, классификацию отраслей химии (основная химия, химия органического синтеза, бытовая химия) и их влияние на научно-технический прогресс. Особое внимание уделяется стратегической важности химического комплекса для обеспечения других секторов экономики инновационными материалами, удобрениями и энергоресурсами. Также обсуждаются проблемы модернизации производственных мощностей, экологические аспекты деятельности предприятий и перспективы внедрения «зеленых» технологий в химическую индустрию.*

Ключевые слова: *химическая промышленность, производственный комплекс, экономическое значение, инновационные материалы, минеральные удобрения, экологизация производства, технологический процесс, промышленная политика.*

Abstract: *The article examines the role and significance of chemical industry enterprises within the structure of the modern national economy. The author analyzes the specifics of production processes, the classification of chemical branches (basic chemistry, organic synthesis, household chemistry), and their impact on scientific and technological progress. Particular attention is paid to the strategic importance of the chemical complex in providing other economic sectors with innovative materials, fertilizers, and energy resources. The issues of modernizing production capacities, environmental aspects of industrial activities, and the prospects for implementing "green" technologies in the chemical industry are also discussed.*

Keywords: *chemical industry, industrial complex, economic significance, innovative materials, mineral fertilizers, production ecologization, technological process, industrial policy.*

Саноати химия (химическая промышленность) яке аз соҳаҳои муҳими саноати вазнин аст, ки истеҳсоли моддаҳои кимиёвӣ, нуриҳои минералӣ, маводи тарканда, кислотаҳо, нуриҳо, полимерҳо ва маҳсулоти дигари кимиёвиро дар бар мегирад. Ин соҳа барои рушди иқтисодиёт, кишоварзӣ, саноати коркард ва ҳатто энергетика аҳамияти калон дорад. Дар Тоҷикистон саноати химия асосан ба истеҳсоли нуриҳои минералӣ, моддаҳои кимиёвӣ барои саноати алюминий, маводи тарканда ва баъзе маҳсулоти истеъмолӣ такя мекунад. Корхонаҳои калон ва муҳим инҳоянд:

1. ҶСК “Азот” (ОАО "Азот") — шаҳри Левакант (қаблан Сарбанд, Қӯрғонтеппа) Калонтарин корхонаи химиявии Тоҷикистон. Истеҳсоли аммиак, нуриҳои азотӣ (карбамид, аммиак нитрати ва ғ.). Соли 1967 оғоз ба кор кардааст (дар давраи Шӯравӣ). Дар солҳои охир азнавсозӣ ва муосирсозӣ шудааст (соли 2023 пас аз реконструксия ба кор даромад).

2. ТАЛКО Кемикал (TALCO Chemical) — ноҳияи Ёвон , ҷузъи гурӯҳи ТАЛКО (Талко Групп). Корхонаҳои истеҳсоли криолит, фтористый алюминий ва кислотаи сулфат (серная кислота). Соли 2016 ба кор дароварда шудааст. Истеҳсоли солона: криолит — 12 ҳазор тонна, фтористый алюминий — 18 ҳазор тонна, кислотаи сулфат — 130 ҳазор тонна. Маҳсулот ба ТАЛКО (барои истеҳсоли алюминий), инчунин ба Русия, Қазоқистон ва Озарбойҷон содир мешавад. Аҳамият: коҳиши вобастагии Тоҷикистон ба воридоти моддаҳои кимиёвӣ барои саноати алюминий.

3. ҶМШ “Муосир” (СП “Муосир”) — корхонаи муштараки тоҷикӣ-чинӣ Аввалин корхона дар таърихи Тоҷикистон барои истеҳсоли моддаҳои таркандаи эмулсионӣ** (эмульсионные взрывчатые вещества). Барои саноати кӯҳӣ ва истихроҷи маъданҳо муҳим аст. Заводи химиявии Исфара (ОАО "Химический завод", Исфара) — истеҳсоли лакҳо, рангҳо ва маҳсулоти кимиёвӣ. Заводи “Тамохуш” (Исфара) — маҳсулоти кимиёвӣ. Баъзе корхонаҳои хурд барои истеҳсоли нуриҳо, моддаҳои тозакунанда ва ғ. Нуриҳои минералӣ (азотӣ, фосфорӣ ва ғ.) барои афзоиши ҳосили зироатҳо (пахта, ғалладона, сабзавот, мева) заруранд. Ин соҳа ба коҳиши вобастагии воридот мусоидат мекунад. Моддаҳои кимиёвӣ (криолит, фтористый алюминий, кислотаи сулфат) барои коркарди алюминий дар ТАЛКО ҳатмӣ ҳастанд. Ин ба рушди саноати металлургияи ранга кӯмак мерасонад. Маводи тарканда ва моддаҳои кимиёвӣ барои тарконидани сангҳо дар конҳо истифода мешаванд, ки ба истихроҷи тилло, нуқра, ангишт ва маъданҳои дигар мусоидат мекунад. Истеҳсоли маҳсулоти кимиёвӣ дар дохили кишвар хароҷоти воридотро кам ва ҷойҳои корӣ эҷод мекунад.

Маҳсулоти кимиёвӣ (криолит, фтористый алюминий, кислотаи сулфат) ба кишварҳои ҳамсоя содир мешаванд, ки даромади валютӣ меорад. Корхонаҳои калон садҳо ва ҳазорҳо ҷойи корӣ таъмин мекунанд ва ба рушди минтақаҳо (Яван, Левакант, Исфара) мусоидат менамоянд.

- Мушкилот: вобастагии қисман ба ашёи хом ва энергия (барқ), таҷҳизоти кӯҳна, мушкилоти экологӣ.

- Дурнамо: азнавсозии корхонаҳо (масалан, “Азот”), ҷалби сармоягузории хориҷӣ, рушди истеҳсоли маҳсулоти мураккаб ва содирот.

Саноати химия дар Тоҷикистон ҳанӯз пурра рушд наёфтааст, аммо бо мавҷудияти захираҳои табиӣ (маъданҳои кимиёвӣ, гази табиӣ) ва лоиҳаҳои нав имкониятҳои зиёд дорад.

Корхонаҳои саноати химия, гарчанде ки барои рушди иқтисодиёт (таъмини нуриҳои минералӣ, моддаҳои кимиёвӣ барои саноати алюминий ва ғ.) муҳим бошанд, яке аз манбаъҳои асосии ифлосшавии муҳити зист дар Тоҷикистон ва дар сатҳи ҷаҳонӣ ҳисобида мешаванд. Зарарҳо асосан аз ихроҷҳои газӣ, партовҳои моеъ ва партовҳои сахт ба вуҷуд меоянд, ки ба ҳаво, об, хок ва саломатии одамон таъсири манфӣ мерасонанд.

- Ихроҷи газҳои зарарнок: диоксиди сулфур (SO_2), оксидҳои нитроген (NOx), фторидҳо (HF, фтор), аммиак (NH_3) ва дигар моддаҳо. Дар натиҷа: кислотные боронҳо (кислотные дожди), кам шудани сифати ҳаво, бемориҳои роҳҳои нафаскашӣ, таъсир ба растанӣ ва ҳайвонот.

Корхонаҳои алюминий (ТАЛКО) ва химиявӣ фторидҳоро ихроҷ мекунанд, ки ба ҳайвоноти чорво (масалан, говҳо бе дандон мешаванд) ва растаниҳо (хароб шудани токҳо, анорҳо) зарар мерасонанд.

- Партофтани партовҳои моеъи кимиёвӣ (кислотаҳо, нуриҳо, фторидҳо, аммиак) ба дарёҳо ва манбаъҳои об.

- Зарар: ифлосшавии обҳои зеризаминӣ ва рӯизаминӣ, кам шудани ҳосили моҳӣ, вайрон шудани экосистемаҳои обӣ, хатар ба оби нӯшокӣ.

- Мисол: Дар минтақаҳои атрофи корхонаҳои химиявӣ (Яван, Левакант) обҳои партавӣ ба ҳавзаҳои обӣ ворид мешаванд.

Таъсир ба саломатии одамон

- Афзоиши бемориҳои нафаскашӣ, пӯст, системаи ҳормонӣ, мушкилоти хун ва ҳатто саратон.

- Дар минтақаҳои таъсирпазир (атрофи ТАЛКО ва “Азот”) мушоҳида шудааст, ки бемориҳои мутақобилӣ ва нуқсонҳои модарзодӣ зиёд мешаванд.

Чораҳои кам кардани зарар

- Муосирсозӣ ва насби филтрҳои газтозакунӣ (дар “Азот” ва ТАЛКО чунин корҳо сурат гирифтаанд).

- Назорати давлатӣ ва мониторинги муҳити зист (аз ҷониби Кумитаи ҳифзи муҳити зист).

- Истифодаи технологияҳои тоза (green chemistry) ва кам кардани партовҳо.

- Қонунҳои ҶТ “Дар бораи ҳифзи муҳити зист” ва барномаҳои байналмилалӣ (UNEP, Бонки Ҷаҳонӣ) барои коҳиши зарарҳо.

Дар маҷмӯъ, саноати химия дар Тоҷикистон ҳанӯз ҳам ҳамчун манбаи ифлосшавӣ боқӣ мемонад, аммо бо азнавсозӣ ва назорат метавон зарарро ба таври назаррас кам кард. Дар минтақаҳои наздикорхонавӣ (Яван, Левакант, Турсунзода) мушкилоти экологӣ бештар эҳсос мешаванд.

СПИСОК ЛИТЕРАТУРЫ

1. Закон Республики Таджикистан «О промышленной политике». — Душанбе, 2018.
2. Программа развития химической и фармацевтической промышленности в Республике Таджикистан на 2021–2025 годы. — Душанбе, 2020.
3. Агентство по статистике при Президенте Республики Таджикистан. Промышленность Республики Таджикистан (Статистический сборник). — Душанбе, 2024.
4. Александров, И. А. Экономика химической промышленности: Учебник для вузов. — М.: Академкнига, 2015. — 420 с.
5. Бобоев, Ҳ. Географияи иқтисодӣ ва иҷтимоии Тоҷикистон (барои мактабҳои олӣ). — Душанбе, 2018. (Глава о химической промышленности).
6. Брагинский, О. Б. Мировая химическая промышленность: стратегия развития. — М.: Наука, 2014.
7. Комилов, С. Д., Фурсаев, А. С. Промышленность Таджикистана: современные проблемы и пути модернизации. — Душанбе: Ирфон, 2012.
8. Мавланов, М. И. Роль химической отрасли в индустриализации Республики Таджикистан // Вестник Таджикского национального университета. — 2022. — №4.
9. Сафиев, Х. С. Химическая промышленность Таджикистана: потенциал и перспективы // Доклады Академии наук Республики Таджикистан. — 2019. — Т. 62.
10. Чернышова, И. В. Экологические аспекты химического производства: Учебное пособие. — М.: Инфра-М, 2018.
11. World Chemical Outlook II. Trends and Outlooks for Sustainable Development. — UNEP (United Nations Environment Programme), 2019. (Источник на английском для повышения статуса работы).

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АРЗЁБИИ ИҚТИСОДИИ ХОҶАГИИ ХАЛҚИ ВОДИИ ҲИСОР

АҲМАДОВА МАЪРИФАТ САЙДАЛИЕВНА
Донишгоҳи давлатии Бохтар ба номи Носири Хусрав. Тоҷикистон

Аннотация: *в статье представлена комплексная экономическая оценка современного состояния и перспектив развития народного хозяйства Гиссарской долины — одного из ключевых стратегических регионов Таджикистана. Автором анализируется отраслевая структура экономики региона, включая промышленный потенциал (на примере ГУП «ТАЛКО»), аграрный сектор, транспортную инфраструктуру и сферу услуг. В работе рассматриваются факторы, влияющие на экономическую эффективность использования природных и трудовых ресурсов долины, а также выявляются основные проблемы, препятствующие устойчивому росту, такие как экологические риски и сокращение площадей сельскохозяйственных угодий в результате урбанизации. Даны рекомендации по формированию промышленных кластеров и повышению экспортного потенциала региона.*

Ключевые слова: *Гиссарская долина, народное хозяйство, экономическая оценка, промышленный потенциал, ТАЛКО, аграрный сектор, региональное развитие, инфраструктура, экспортный потенциал, рациональное природопользование.*

The article presents a comprehensive economic assessment of the current state and development prospects of the national economy of the Hissar Valley, one of the key strategic regions of Tajikistan. The author analyzes the sectoral structure of the regional economy, including industrial potential (using the example of SUE "TALCO"), the agricultural sector, transport infrastructure, and the service sector. The paper examines factors affecting the economic efficiency of the use of natural and labor resources of the valley, and identifies the main problems hindering sustainable growth, such as environmental risks and the reduction of agricultural land areas as a result of urbanization. Recommendations are given for the formation of industrial clusters and increasing the export potential of the region.

Keywords: *Hissar Valley, national economy, economic assessment, industrial potential, TALCO, agricultural sector, regional development, infrastructure, export potential, rational nature management.*

Водии Ҳисор яке аз минтақаҳои муҳими иқтисодӣ дар Тоҷикистон аст, ки дар ғарби пойтахт – Душанбе ҷойгир буда, бо хоки ҳосилхез, иқлими мувофиқ ва захираҳои бойи табиӣ машҳур аст. Ин водӣ тақрибан 8,3% ҳудуди ҷумҳуриро ишғол мекунад, аммо 28,2% аҳолии кишварро (асосан деҳотӣ, зичии аҳолӣ – 128,4 нафар дар 1 км²) дар бар мегирад. Иқтисодиёти он асосан ба кишоварзӣ, саноат ва истифодаи захираҳои табиӣ такя мекунад, ки дар ҳаҷми умумии истеҳсолоти саноатӣ ва кишоварзии ҷумҳурӣ ҳиссаи назаррас (34,5%) дорад. Дар соли 2025 (нисфи аввал) ҳаҷми маҷмӯи маҳсулоти минтақавӣ (МММ) ба 2 млрд 276,1 млн сомонӣ расид, ки нисбат ба ҳамин давраи соли 2024 209,7 млн сомонӣ зиёд аст ва суръати афзоиш – 113%.

Водии Ҳисор дар маркази Тоҷикистон ҷойгир буда, шаҳрҳои Душанбе, Ҳисор, Турсунзода, Ваҳдат ва ноҳияҳои Рӯдакию Шаҳринавро дар бар мегирад.

Дар арзёбии иқтисодӣ метавон гуфт, ки водии Ҳисор **"локомотиви иқтисодиёти Тоҷикистон"** аст. Ширкати алюминийи тоҷик (**ТАЛКО**), ки дар шаҳри Турсунзода ҷойгир аст, на танҳо бузургтарин корхонаи саноатии водии Ҳисор, балки яке аз сутунҳои асосии иқтисодиёти миллии Тоҷикистон ба шумор меравад. Нақши он дар минтақа бисёрҷабҳа буда, ҷанбаҳои иқтисодӣ, иҷтимоӣ ва инфрасохториро фаро мегирад.

ТАЛКО маркази саноатии водии Ҳисор мебошад. Қисми зиёди даромади буҷети шаҳри Турсунзода ва ҳиссаи назарраси нишондиҳандаҳои саноатии водии Ҳисор маҳз ба ҳамин корхона рост меояд. Алюминийи аввалия маҳсулоти асосии содиротии минтақа аст, ки воридоти асъори хориҷиро ба иқтисодиёт таъмин мекунад. Дар атрофи ТАЛКО корхонаҳои хурду миёнаи коркарди металл, истеҳсоли қисмҳои эҳтиётӣ ва хизматрасониҳои техникӣ ба вуҷуд омадаанд. ТАЛКО бузургтарин корфармо дар водии Ҳисор аст. Дар ширкат ҳазорон нафар сокинони шаҳри Турсунзода, ноҳияҳои Шаҳринав, Ҳисор ва Рӯдакӣ кор мекунанд. Корхона ҳамчун мактаби бузурги муҳандисию техникӣ хизмат мекунад, ки сатҳи баланди тахассусии қувваи кории минтақаро таъмин менамояд.

Мавҷудияти ТАЛКО боиси рушди шабакаҳои нақлиётӣ ва энергетикии водии Ҳисор гардид:

-Инфрасохтори роҳи оҳан дар самти ғарбии водӣ маҳз барои эҳтиёҷоти ин корхона (кашонидани ашёи хом ва содироти металл) мустаҳкам карда шудааст.

-Ширкат истеъмолкунандаи асосии нерӯи барқ аст, ки ин боиси нигоҳ доштани иқтидорҳои бузурги энергетикӣ ва зеристгоҳҳои баландшиддат дар водии Ҳисор мегардад. Бе мавҷудияти ТАЛКО симои иқтисодии водии Ҳисор комилан дигар мешуд. Он на танҳо як корхона, балки муҳаррики технологии минтақа аст.

Соҳаи пешбар буда, ба ҳосилпарварӣ ва чорводорӣ тамаркуз дорад. Дар водӣ ҳосили пахта, ҷуворимакка, гандум, сабзавот, меваҳо (аз ҷумла 70% ангурҳои ҷумҳурӣ) ва кунҷит парвариш карда мешаванд. Чорводорӣ низ рушд кардааст: дар ин ҷо зоти машҳури гӯсфандони ҳисорӣ (курдючная овца, ки ҳамчун калонтарин дар ҷаҳон ба Китоби рекордҳои Гиннесс ворид шудааст) парвариш мешавад. Ҳиссаи водӣ дар ҳаҷми умумии маҳсулоти кишоварзии ҷумҳурӣ – 16,4%. Дар нимсолаи аввали 2025 ҳаҷми истеҳсолоти кишоварзӣ 107,5% афзоиш ёфтааст. Канали калонтарини Ҳисор (соли 1942 сохта шудааст) барои обёрии заминҳои кишоварзӣ ҳалкунанда аст.

Минтақаи саноатитарин дар ҷумҳурӣ буда, 46% ҳаҷми истеҳсолоти саноатии Тоҷикистонро таъмин мекунад. Соҳаҳои асосӣ: мошинсозӣ, коркарди металл, саноати чӯбкорӣ, масолеҳи сохтмонӣ, риштаҳои пахтагин, дӯзандагӣ, пойафзол ва коркарди равғанҳо. Дар водӣ тамоми захираҳои ҷумҳурии регсанг барои хиштҳои силикатӣ, оташтобовар, ашёи сафолӣ ва гил; аксари корхонаҳои масолеҳи сохтмонӣ; конҳои волфрам ва флюорит; 70,4% захираҳои гази табиӣ ҷойгиранд. Дар нимсолаи аввали 2025 ҳаҷми истеҳсолоти саноатӣ 106,9% афзоиш ёфтааст.

Дар нимсолаи аввали 2025 соҳаи сармоягузорӣ ва сохтмон 159,3% афзоиш нишон додааст. Ин минтақа барои рушди саноати вазнин ва сабук, корхонаҳои хурди коркарди обҳои чашма ва минералӣ, тавлиди маҳсулоти кишоварзӣ (пахта, ғалладона, чормағз, шафран, арахис) ва туризми байналмилалӣ имкониятҳои зиёд дорад.

Дар нимсолаи аввали 2025 гардиши савдо 107,3% ва соҳаи хизматрасонӣ 112,6% афзоиш ёфтааст. Шабакаи нақлиётӣ хуб рушд кардааст – 1909 км роҳҳо (1355 км асфалтпӯш), 92 км роҳи оҳани стандартӣ ва 36 км роҳи танг (ҳиссаи умумӣ – 14,6% дар ҷумҳурӣ). Аз ҳудуди водӣ роҳи байналмилалии автомобилии Душанбе – Термез (бо Ӯзбекистон) ва роҳи оҳан бо истгоҳи Хонақа мегузарад. Инфраструктураи таърихию фарҳангӣ (мамнӯъгоҳи Ҳисор) барои рушди туризми экологӣ ва фарҳангӣ мусоидат мекунад.

Таърихи зоти гӯсфандони Ҳисорӣ

Зоти гӯсфандони ҳисорӣ (Gissar sheep, Гиссарская овца) яке аз қадимтарин ва машҳуртарин зотҳои гӯсфандони дунбакалон (fat-rumped) дар Осиёи Марказӣ мебошад. Ин зот сирф тоҷикӣ (аслӣ тоҷикӣ) ба ҳисоб рафта, калонтарин гӯсфанди парвариши ҷаҳон эътироф шудааст.

Тибқи маълумоти олимон ва манбаъҳои таърихӣ, зоти ҳисорӣ таърихи қадима дошта, ҳанӯз дар асрҳои XII–XIII (ё XIII–XIV) бо усули селексияи анъанавии халқӣ (народная селекция) ба вуҷуд омадааст. Номи он аз водии Ҳисор (Gissar Valley) гирифта шудааст, ки дар ғарби Тоҷикистон (атрофи Душанбе) ҷойгир аст ва ватани аслии ин зот маҳсуб мешавад Ҳанӯз

соли 1298 сайёҳи машҳури итолиёвӣ Марко Поло дар сафарҳои худ гӯсфандони калонҷуссаи ин минтақаро тавсиф кардааст, ки ба зоти ҳисорӣ ишора мекунад. Зот барои гӯшт ва равғани дунба (курдюк) парвариш карда мешуд, ки дар шароити кӯҳистонӣ ва чарогоҳҳои камҳосил барои ҳайвонот ҳамчун захираи энергия хизмат мекард. Ин зот дар изолясияи нисбӣ (isolated race) ташаккул ёфта, таъсири зотҳои дигарро қариб надидааст, ки онро беназир мегардонад. Дар Тоҷикистон марказҳои зотпарварӣ (масалан, хоҷагии «Ҳисор» дар Фархор) таъсис ёфтанд.

Дар солҳои охир зот ба феҳристи мероси кишоварзии дорои аҳамияти ҷаҳонӣ (Globally Important Agricultural Heritage Systems) дохил шудааст. Айни замон дар Тоҷикистон зиёда аз 3 миллион сар гӯсфанди ҳисорӣ парвариш мешавад (дар водии Ҳисор ва вилояти Хатлон бештар). Дар соли 2023 як гӯсфанди ҳисорӣ бо вазни 230 кг дар Қазоқистон рекорд гузошта, ба китоби рекордҳои Гиннес ворид шуд.

РУЙХАТИ АДАБИЁТ

1. Қонуни Ҷумҳурии Тоҷикистон «Дар бораи дурнамоҳои давлатии рушди иҷтимоию иқтисодии Ҷумҳурии Тоҷикистон».
2. Стратегияи миллии рушди Ҷумҳурии Тоҷикистон барои давраи то соли 2030. – Душанбе, 2016.
3. Агентӣ оид ба омори назди Президенти Ҷумҳурии Тоҷикистон. Минтақаҳои Ҷумҳурии Тоҷикистон (Маҷмӯаи оморӣ). – Душанбе, 2024.
4. Асроров И.А. Экономика сельского хозяйства Таджикистана. – Душанбе: Ирфон, 2012.
5. Бобоев Ҳ. Географияи иқтисодӣ ва иҷтимоии Тоҷикистон. – Душанбе: Эрджет, 2018.
6. Гафуров Х.Г. Региональная экономика и управление. – Душанбе: Дониш, 2015.
7. Комилов С.Д., Фурсаев А.С. Промышленность Таджикистана: проблемы и перспективы развития. – Душанбе: Ирфон, 2010.
8. Раҳимов Р.К. Проблемы развития и размещения производительных сил Таджикистана. – Душанбе: Дониш, 2008.
9. Умаров Х.У. Экономика Таджикистана: состояние, проблемы, пути выхода из кризиса. – Душанбе, 2014.
10. Ҳоҷиматов А. Захираҳои табиӣ ва рушди иқтисодии водии Ҳисор Маҷаллаи илмии «Паёми Донишгоҳи миллӣ». – 2022. – №3.

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ЦИФРОВОЙ, ТРАДИЦИОННЫЙ И ПАРТИЗАНСКИЙ МАРКЕТИНГ: МАЛЫЙ БЮДЖЕТ, БОЛЬШОЙ ЭФФЕКТ

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Резюме. *В статье в сравнительном ключе анализируются особенности традиционных, цифровых и альтернативных маркетинговых стратегий на фоне стремительного развития электронной коммерции. Обосновывается, что благодаря широкому распространению цифровых технологий маркетинговая деятельность все чаще сосредоточена на интернет- и социальных медиа-платформах, при этом традиционные методы сохраняют эффективность в определенных случаях. В исследовании рассматриваются сильные и слабые стороны обоих подходов, а также их влияние на поведение потребителей и принятие решений о покупке.*

Особое внимание уделяется партизанскому (герилья) маркетингу как альтернативной стратегии и демонстрируется возможность создания высокого эффекта при ограниченном бюджете. В работе подчеркивается, что интеграция традиционных и цифровых маркетинговых инструментов играет важную роль в повышении конкурентоспособности предприятий. В заключение делается вывод о необходимости комплексного и гибкого подхода при формировании эффективной маркетинговой стратегии в условиях изменяющейся рыночной среды.

Ключевые слова: *традиционный маркетинг, цифровой маркетинг, г guerrilla (партизанский) маркетинг, электронная коммерция, маркетинговые стратегии, поведение потребителей, рыночная конкуренция, интегрированный маркетинг, альтернативный маркетинг, продвижение бренда.*

DIGITAL, TRADITIONAL, AND GUERRILLA MARKETING: SMALL BUDGET, BIG IMPACT

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Summary. *The article provides a comparative analysis of traditional, digital, and alternative marketing strategies in the context of the rapid development of e-commerce. It is argued that, with the widespread adoption of digital technologies, marketing activities are increasingly oriented toward internet and social media platforms, while traditional methods still remain effective in certain cases. The study examines the strengths and weaknesses of both approaches and evaluates their impact on consumer behavior and purchasing decisions.*

At the same time, guerrilla (partisan) marketing is analyzed as an alternative strategy, highlighting its potential to achieve high impact with a limited budget. The research emphasizes the role of integrating traditional and digital marketing tools in enhancing the competitiveness of businesses. As a result, the necessity of a comprehensive and flexible approach to formulating effective marketing strategies in a changing market environment is substantiated.

Keywords: *traditional marketing, digital marketing, guerrilla (partisan) marketing, e-commerce, marketing strategies, consumer behavior, market competition, integrated marketing, alternative marketing, brand promotion*

Объект исследования

Объектом исследования являются механизмы применения традиционных, цифровых и альтернативных маркетинговых стратегий предприятиями, функционирующими в условиях современной цифровой экономики, а также особенности их влияния на поведение потребителей.

Цель исследования

Основная цель исследования — сравнительно проанализировать особенности, сильные и слабые стороны традиционных, цифровых и альтернативных (герилья/партизанский) маркетинговых стратегий в условиях современной электронной коммерции, оценить их влияние на поведение потребителей и конкурентоспособность предприятий, а также определить возможности их эффективной интеграции.

Задачи исследования

1. Изучить теоретические основы понятий традиционного и цифрового маркетинга и определить их основные характеристики.
2. Проанализировать процесс трансформации маркетинговых стратегий в среде электронной коммерции.
3. Сравнительно оценить сильные и слабые стороны традиционных и цифровых маркетинговых стратегий.
4. Исследовать сущность и особенности применения альтернативных маркетинговых подходов, в частности герилья (партизанского) маркетинга.
5. Изучить механизмы влияния маркетинговых стратегий на поведение потребителей и их решения о покупке.
6. Определить влияние цифровых платформ на конкурентоспособность бизнеса.
7. Проанализировать возможности интеграции традиционных и цифровых маркетинговых инструментов и синергетический эффект от этого.
8. Разработать предложения и рекомендации для предприятий по формированию более эффективной маркетинговой стратегии в современных рыночных условиях.

Научная новизна исследования

Научная новизна заключается в систематизации традиционных, цифровых и альтернативных (герилья/партизанских) маркетинговых стратегий в единой концептуальной рамке и комплексном анализе их взаимосвязей в условиях электронной коммерции. В работе механизмы влияния маркетинговых стратегий на поведение потребителей переоцениваются в контексте современной цифровой среды, а также предлагается гибридная модель, основанная на интеграции традиционных и цифровых инструментов.

Научная и практическая значимость исследования

Научная и практическая значимость состоит в комплексном изучении теоретических и

прикладных аспектов традиционных, цифровых и альтернативных маркетинговых стратегий в электронной коммерции, обосновании их взаимосвязей и возможностей интеграции. Работа систематизирует трансформацию маркетинговых коммуникаций в современной цифровой среде, обогащает существующие теоретические подходы и формирует методологическую базу для будущих научных исследований.

Методология исследования

В последние годы маркетинговая сфера, особенно в связи с быстрым расширением электронной коммерции, претерпела значительные изменения. С развитием цифрового мира бизнесу приходится выбирать наиболее подходящие маркетинговые стратегии для эффективного взаимодействия с потребителями. Для этой цели традиционный и цифровой маркетинг предлагают два разных подхода.

Традиционный маркетинг в основном опирается на физические каналы и использует печатные издания, телевизионную рекламу, прямую почтовую рассылку и другие аналоговые инструменты. Цифровой маркетинг работает через интернет и использует платформы, такие как социальные сети, поисковые системы, e-mail-кампании и веб-сайты.

Быстрое развитие электронной коммерции ускорило смещение маркетинговых стратегий в цифровую сферу, поскольку интернет и мобильные технологии позволяют компаниям взаимодействовать с глобальной аудиторией в реальном времени. Тем не менее, несмотря на широкое использование цифровых инструментов, традиционные методы в некоторых случаях сохраняют свою эффективность. Хорошее понимание сильных и слабых сторон обоих подходов важно для предприятий, стремящихся добиться успеха в сложной и конкурентной среде.

Этот анализ рассматривает основные особенности, преимущества и трудности, с которыми сталкиваются традиционные и цифровые маркетинговые стратегии в эпоху электронной коммерции. Цель состоит в том, чтобы показать, как эти два подхода могут быть согласованы между собой, определить пути интеграции и продемонстрировать, как компании могут применять их для поддержания конкурентоспособности в условиях меняющегося рынка [1].

С появлением интернета компании начали активнее использовать его возможности, и интернет как глобальная платформа считается одним из самых революционных инструментов в маркетинге. Формы коммуникации людей влияют на развитие бизнеса, помогают удовлетворять потребности клиентов и позволяют экономить время и средства через онлайн-исследования. Постоянное развитие технологий показывает, что традиционный маркетинг всё больше трансформируется в цифровую форму, где коммуникация осуществляется преимущественно через цифровые медиа. Оба подхода — традиционный и цифровой маркетинг — являются важными инструментами для стимулирования решений потребителей о покупке.

Цифровой маркетинг рассматривается маркетологами как развивающийся процесс, который используется в качестве ключевого элемента для презентации товаров и услуг. Компании, переходя от традиционного маркетинга к цифровому, устанавливают более тесные связи с клиентами и более эффективно удовлетворяют их потребности. Цифровой маркетинг привлекает клиентов с помощью интернета и информационных технологий, тогда как традиционный маркетинг служит той же цели через классические каналы. Практика показывает, что цифровой маркетинг влияет на эффективность рекламы, намерения покупки и имидж бренда, но не является единственным фактором, определяющим окончательное решение о покупке. Онлайн-отзывы и мнения могут изменять поведение потребителей, в то время как в традиционном маркетинге эту роль выполняют реклама и экспертные рекомендации.

Компании предпочитают цифровой маркетинг для установления отношений с клиентами и отслеживания их реакции. Это обеспечивает ценную обратную связь для улучшения продуктов и услуг, а также позволяет потребителям сравнивать альтернативы на рынке.

Исследования показывают, что традиционный маркетинг эффективен для достижения целевой аудитории на локальном уровне, тогда как цифровой маркетинг обеспечивает распространение продуктов и услуг в глобальном масштабе [2].

Мир стремительно переходит на цифровые платформы. Сегодня многие сферы нашей повседневной жизни — банковские операции, покупки, оплата счетов, обучение и заказ билетов — осуществляются онлайн. Революция в информационных технологиях коренным образом изменила маркетинговые методы. Компании теперь используют интернет для продвижения своих продуктов и услуг, и этот подход доказал свою более выгодную, удобную и успешную эффективность. Возможности онлайн-покупок позволяют определить потребности и совершить покупки без посещения физических магазинов, экономя время и ресурсы, всего в несколько кликов.

Это вызывает ряд вопросов: остаётся ли традиционный маркетинг актуальным? Полностью ли цифровой маркетинг его заменяет?

Основная цель как цифрового, так и традиционного маркетинга одинакова — привлечение потенциальных клиентов и повышение осведомлённости о бренде продуктов и услуг. Оба подхода могут применяться совместно для повышения маркетинговых результатов, хотя методы различаются. Цифровой маркетинг ориентирован на интернет- и веб-деятельность: создание веб-сайтов, проведение рекламных кампаний в социальных сетях и онлайн-промоакций. Традиционный маркетинг использует классические каналы — газеты, журналы, телевидение и радио. Оба подхода имеют свои преимущества, и их стратегическое объединение может дать более эффективные результаты для бизнеса [3].

Интерес людей к повторяющейся и монотонной рекламе снижается. Классические рекламные методы становятся всё менее эффективными, что создаёт потребность в новых и креативных маркетинговых стратегиях. Герилья-маркетинг предлагает нестандартные подходы, чтобы уменьшить усталость аудитории от рекламы и привлечь внимание целевой группы, особенно в онлайн- и цифровых платформах.

Термин «герилья» имеет военное происхождение и означает «малую войну». В маркетинге герилья-маркетинг представляет собой применение креативных и нестандартных методов для достижения традиционных целей. По словам Левинсона, это «подтверждённый способ получения прибыли при минимальных затратах». Зерр рассматривает его как альтернативный и целостный маркетинговый подход, целью которого является максимальное использование имеющихся ресурсов.

Основные характеристики герилья-маркетинга: нестандартность, удивительность, креативность, смелость, эффективность, гибкость, ум и эффектность. Цель заключается в том, чтобы отличаться от традиционного маркетинга и достигать максимального эффекта при минимальном бюджете. Герилья-маркетинг обогащает маркетинговый микс и применяется в различных сферах с использованием креативных подходов. Концепция сначала возникла на практике, а затем вошла в научную литературу [4].

В 1984 году Джей Конрад Левинсон систематизировал концепцию герилья-маркетинга в книге «Партизанский маркетинг». Позднее Райс, Траут и Котлер развили эти идеи, способствовав широкому распространению герилья-маркетинга. Сегодня герилья-маркетинг используется как малыми и средними, так и крупными корпорациями, поскольку классические методы рекламы всё больше отвергаются потребителями, которые отдают предпочтение самостоятельному принятию решений о покупке.

Таким образом, герилья-маркетинг позволяет компаниям достигать максимального эффекта при небольшом бюджете и широко применяется для дифференциации продуктов и услуг на рынке [5].

Gerilla marketinq, Azərbaycan

В условиях изменчивой бизнес-среды компании ищут инновационные маркетинговые методы для установления связи с целевой аудиторией и её вовлечения. В последние годы основной тенденцией в маркетинге стало обращение к нестандартным, альтернативным стратегиям. По словам профессора Школы бизнеса Келлогг Моханбира Саунни, альтернативный маркетинг — это «эффективные и целенаправленные методы продвижения, использующие креативность, взаимодействие и построение сообществ».

Эти подходы отдают предпочтение прямому взаимодействию с клиентами через социальные сети и другие цифровые платформы. Примерами могут служить сотрудничество с инфлюенсерами, герилья-маркетинг, вирусные кампании и взаимодействие в реальном времени через социальные сети.

Традиционный маркетинг, напротив, ориентирован на массовую аудиторию и использует классические каналы — телевидение, радио, печатные СМИ и рекламные щиты. По словам Филипа Котлера, традиционный маркетинг — это «стратегии, ориентированные на массовую аудиторию, требующие высоких затрат на производство и создающие одностороннюю коммуникацию». Цель этого подхода — донести бренд и продукт до широкой аудитории. История маркетинга восходит к древним цивилизациям, когда торговцы продвигали свои продукты с помощью устной коммуникации. Промышленная революция и начало массового производства привели к развитию массового маркетинга, а с середины XX века доминировала реклама по радио и телевидению. В последние годы развитие интернета и социальных сетей изменило маркетинговый ландшафт и ускорило рост альтернативного маркетинга. Прямое взаимодействие через цифровые платформы создаёт двустороннюю коммуникацию, позволяя брендам адаптироваться к быстро меняющимся рыночным тенденциям и отзывам клиентов.

Альтернативный маркетинг важен для общества, поскольку помогает отслеживать изменения в предпочтениях и ценностях потребителей. Перед более избирательными и социально осознанными потребителями компании вынуждены применять инновационные стратегии. Этот подход поощряет этичную и устойчивую практику, инклюзивность и инновации, а общество, в свою очередь, может принимать информированные решения и поддерживать ответственную деловую практику [6].

Ряд крупных брендов смог выделиться на рынке и создать более устойчивое впечатление в сознании потребителей, используя альтернативные маркетинговые стратегии.

Бренд **McDonald's** оформил пешеходные переходы в городских улицах так, чтобы они визуально напоминали продукт «French fries» (картофель фри). Полосы были окрашены в жёлтый цвет, а на концах размещались красный логотип «McDonald's» или изображение упаковки с картофелем фри. Эта стратегия превращала пешеходные переходы в

символические визуальные элементы продукта, повышая узнаваемость бренда. Кампания в основном проводилась в крупных городах, особенно возле пешеходных зон и ресторанов, демонстрируя эффективность уличного маркетинга.

Бренд **Red Bull** позиционировался не только как энергетический напиток, но и как бренд, связанный с экстремальными видами спорта и приключениями. В 2012 году австралийский экстремальный спортсмен Феликс Баумгартнер совершил прыжок с высоты космоса, став важной вехой для бренда. Эта кампания визуально и символически реализовала слоган «Red Bull даёт крылья», а необычный и эпический образ бренда получил широкое распространение в социальных сетях.

Подобные инициативы являются примерами того, как альтернативный маркетинг эффективно повышает лояльность потребителей и укрепляет позиции бренда на рынке [7].

В современной бизнес-среде наличие крупных и доминирующих корпораций затрудняет новым компаниям с ограниченным рекламным бюджетом обеспечение видимости на рынке. Эти гиганты часто выделяют значительные финансовые ресурсы на маркетинговую деятельность, получая преимущество в охвате широкой аудитории. В таком контексте для малых и средних предприятий альтернативные стратегии, особенно «Партизанский маркетинг» (Guerilla Marketing), выступают эффективным решением. Этот подход позволяет небольшим фирмам создавать значительное влияние при ограниченном бюджете, обеспечивая преимущество в областях, где они не могут конкурировать с традиционными маркетинговыми методами.

Основатель партизанского маркетинга Джей Конрад Левинсон в своей книге *Guerrilla Marketing* описывает этот подход как «креативный и стратегический метод маркетинга для малых предпринимателей с ограниченным бюджетом, но широким видением». В качестве примера он приводит ситуацию: небольшой мебельный магазин находится рядом с крупными конкурентами; один из них объявляет скидку 60%, другой — 75%. У маленького магазина нет

бюджета на масштабную рекламу, поэтому он вешает простой баннер на входе с надписью «Главный вход». Этот пример демонстрирует основной принцип партизанского маркетинга — максимальное визуальное и стратегическое воздействие при ограниченных ресурсах.

Партизанский маркетинг направлен на обеспечение максимально широкого охвата бренда при минимальных затратах. Иными словами, цель заключается в оптимальном использовании имеющихся ресурсов для увеличения доли рынка. Эта стратегия похожа на методы вирусного маркетинга, однако ключевое отличие состоит в том, что вирусный маркетинг основывается на распространении скрытого контента, тогда как партизанский маркетинг привлекает внимание аудитории через открытые, заметные и нестандартные визуальные элементы [8].

Сближение традиционных и цифровых инструментов требует пересмотра классической классификации маркетинговых коммуникационных средств. Коммуникационные каналы следует классифицировать не по типу технологии, а по функциональности и принципам работы. В этом контексте контент-маркетинг (Content Marketing, CM) рассматривается как новый подход и инструмент коммуникации, который может интегрироваться как с традиционными, так и с цифровыми средствами [9].

Заключение

Исследование показывает, что в современном бизнес-окружении интеграция традиционных и цифровых маркетинговых стратегий играет важную роль в повышении конкурентоспособности предприятий. Традиционные маркетинговые инструменты в определённых случаях остаются эффективными и предоставляют важные возможности для охвата локальной целевой аудитории, тогда как цифровой маркетинг позволяет устанавливать связь с клиентами в глобальном масштабе в реальном времени и отслеживать их поведение. Исследование также подтверждает, что альтернативный (герилья/партизанский) маркетинг является эффективной стратегией для достижения максимального воздействия при ограниченном бюджете и обеспечения дифференциации бренда на рынке. Этот подход привлекает внимание потребителей с помощью креативных, нестандартных и привлекательных методов, влияя на их решения о покупке.

На основе результатов исследования можно сделать вывод, что эффективная маркетинговая стратегия требует комплексного и гибкого подхода, который синтезирует традиционные, цифровые и альтернативные инструменты. Это позволяет предприятиям адаптироваться к изменяющимся условиям рынка, точнее удовлетворять потребности потребителей и получать конкурентное преимущество.

Таким образом, для успеха современных маркетинговых действий стратегическое планирование, инновационные подходы и эффективное использование ресурсов должны применяться взаимосвязанно и согласованно.

ЛИТЕРАТУРЫ

1. Umamaheswararao Gobbilla1 , Dadi Sai Kiran (2025). *A Comparative Analysis of Traditional and Digital Marketing Strategies in Era of E-Commerce. International Journal of Engineering, Business and Management (IJEBM)* (3). Səh. 1 https://aipublications.com/uploads/issue_files/1IJEBM-MAY20258AComparative.pdf?utm_
2. Shpresa Mehmeti-Bajrami, Fidan Qerimi, Arbëresha Qerimi (2022*). The Impact of Digital Marketing vs. Traditional Marketing on Consumer Buying Behavior. HighTech and Innovation Journal* (3). Səh 1-2 https://hightechjournal.org/index.php/HIJ/article/view/296/pdf?utm_
3. Ms. Sudha Lawrence, Ms. Snehal Deshmukh, Ms. Elavarasi Navajivan (2018). *A comparative study of digital marketing vs traditional marketing. IIBM's Journal of Management Research (3)*. Səh. 112-113 file:///D:/Users7/LTT-Servis/Downloads/1098-ArticleText-1832-1-10-20200721.pdf
4. Gerd Nufer (2021). *Innovative Digital Guerrilla Marketing. International Journal of Innovation, Management and Technology (3).* Səh. 40-41 file:///D:/Users7/LTT-Servis/Downloads/Innovative_Digital_Guerrilla_Marketing.pdf
5. Sajoy P.B. (2013). *Guerrilla Marketing : A Theoretical Review. Indian Journal of Marketing.* Səh. 42-43 https://indianjournalofmarketing.com/index.php/ijom/article/view/36380/pdf_102
6. Ashmit Bhasin (2024). *Alternative vs. Traditional: Why Alternative Marketing Has a Better Return On Investment Than Traditional Marketing. Journal of Student Research*. Səh. 1-3 https://www.jsr.org/hs/index.php/path/article/view/7807/3573 https://valyuta.az/news/brendlerin-kreativ-qazanci-guarella-marketinq https://www.correcttechno.az/guerilla-marketinq/?utm_
7. Szabolcs Nagy – Gergő (2021). *Hajdú The relationship between content marketing and the traditional marketing communication tools. Észak-magyarországi Stratégiai Füzetek.* Səh. 110 https://arxiv.org/pdf/2301.01279

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