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Algorithmization of Emergency Managerial Decisions in the IT Sector under Conditions of Uncertainty

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Abstract. The strengthening of algorithmization is accompanied by the transformation of the role of the manager - from a subject of direct decision-making to a coordinator of interaction between digital platforms, analytical systems and rapid response mechanisms. The dependence of business processes on the continuity of digital operations is a prerequisite for transforming traditional crisis management mechanisms. It has been established that in the modern IT environment, management decisions are increasingly formed within the framework of algorithmic systems of analysis, forecasting and digital response based on streaming data processing in real time.

The features of algorithmization of emergency management decisions are revealed, and the key stages of this process are identified. It has been proven that the effectiveness of algorithmization depends not only on the level of automation of analytical processes, but also on the ability of the management system to provide adaptive response in non-standard crisis situations.

The transformation of the manager's role amid the spread of algorithmic decision-making systems has been investigated. It has been established that the strengthening of algorithmization is accompanied by a shift in management functions from direct decision-making to coordinating interactions among digital platforms, analytical systems, and rapid-response teams. It is evident that excessive reliance on automated mechanisms poses risks of cognitive degradation in management processes, loss of critical thinking, and reduced ability to respond effectively to unpredictable crisis scenarios.

It has been established that the key condition for the effectiveness of algorithmization of emergency management decisions is the preservation of the cognitive potential of the organization and the formation of adaptive models of crisis management, within which the algorithmic speed of analysis is combined with strategic control, managerial flexibility, and the ability of a person to adjust digital decisions in conditions of high uncertainty.

Keywords: management algorithmization; emergency management decisions; IT sector; crisis management; artificial intelligence; digital transformation; cognitive potential of the organization; adaptive management; data-driven management; information uncertainty; remote employment.

Алгоритмізація екстрених управлінських рішень в іт-секторі в умовах невизначеності

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Анотація. Посилення алгоритмізації супроводжується трансформацією ролі управлінця - від суб'єкта безпосереднього прийняття рішень до координатора взаємодії між цифровими платформами, аналітичними системами та механізмами оперативного реагування. У статті досліджено теоретичні та прикладні аспекти алгоритмізації екстрених управлінських рішень в IT-секторі в умовах невизначеності. Обґрунтовано, що зростання складності цифрової інфраструктури, поширення кіберризиків, інформаційне перевантаження та висока залежність бізнес-процесів від безперервності цифрових операцій формують передумови для трансформації традиційних механізмів кризового управління. Встановлено, що в сучасному IT-середовищі управлінське рішення дедалі більше формується у межах алгоритмізованих систем аналізу, прогнозування та цифрового реагування, заснованих на потоковій обробці даних у режимі реального часу.

Розкрито особливості алгоритмізації екстрених управлінських рішень та визначено ключові етапи цього процесу. Доведено, що ефективність алгоритмізації залежить не лише від рівня автоматизації аналітичних процесів, а й від здатності системи управління забезпечувати адаптивне реагування в умовах нестандартних кризових ситуацій.

Досліджено трансформацію ролі управлінця в умовах поширення алгоритмічних систем прийняття рішень. Встановлено, що посилення алгоритмізації супроводжується зміщенням функцій управління від безпосереднього формування рішень до координації взаємодії між цифровими платформами, аналітичними системами та командами оперативного реагування. Обґрунтовано, що надмірна залежність від автоматизованих механізмів породжує ризики когнітивної деградації управлінських процесів, втрати критичного мислення та зниження здатності ефективно реагувати на непередбачувані кризові сценарії.

Встановлено, що ключовою умовою ефективності алгоритмізації екстрених управлінських рішень є збереження когнітивного потенціалу

організації та формування адаптивних моделей кризового управління, у межах яких алгоритмічна швидкість аналізу поєднується зі стратегічним контролем, управлінською гнучкістю та здатністю людини коригувати цифрові рішення в умовах високої невизначеності.

Ключові слова: алгоритмізація управління; екстрені управлінські рішення; IT-сектор; кризове управління; штучний інтелект; цифрова трансформація; когнітивний потенціал організації; адаптивне управління; data-driven управління; інформаційна невизначеність; дистанційна зайнятість.

Statement of the problem in a general way. The modern IT sector operates in an environment where the pace of change increasingly outpaces the ability of classical management models to ensure timely responses to crises. Cyberattacks, cloud infrastructure failures, failures of digital services, data leaks, instability of energy systems, information overload, and high dependence of business processes on the continuity of digital operations create conditions in which management decisions must be made almost instantaneously, often in the absence of time, incompleteness of information, and a high level of risk. The potential of traditional crisis management mechanisms is diminished, and their effectiveness is eroded by excessive inertia, multi-level coordination, and reliance on the human element.

At the same time, the complexity of the IT systems themselves is growing. The architecture of digital platforms is becoming increasingly distributed, and management processes are multi-component and dynamic. These conditions create situations in which even a local technical failure can escalate into a large-scale crisis due to the cascading effects of interconnected digital services. The ability of the management system to quickly process large amounts of data, prioritize threats, predict possible scenarios, and automate individual stages of decision-making comes to the fore.

In response to this, the IT sector is seeing a trend towards the algorithmization of emergency management decisions, involving automated analysis models, decision support systems, AI analytics, predictive mechanisms, and digital response protocols.

It is not only about the technical automation of individual operations, but about the gradual transformation of the very logic of crisis management - from a reactive and intuitive approach to adaptive algorithmic control based on real-time data processing.

Analysis of recent research and publications. In recent years, the problems of digital transformation of management, the use of artificial intelligence and algorithmization of decision-making processes in the IT sector have become the subject of active scientific research both in Ukraine and abroad. In modern scientific works, attention is increasingly focused on the transition from traditional management models to data-driven management, within which data analytics, digital platforms, cloud services, and decision support systems play a key role.

Among foreign scientists, the issues of digital transformation in management processes are investigated by A. Alvarenga, F. Matos, R. Godina, and J. Matthias, who examined the relationship among digitalization, knowledge management, and organizational adaptability [1]. V. Kusuma Kumari analyzes the impact of artificial intelligence on modern management mechanisms, focusing on the transformation of corporate management under the influence of AI analytics and automated decision support systems [2]. Certain aspects of organizational adaptation to the challenges of Industry 4.0 are highlighted in the works of K. Stakhova, J. Papula, Z. Stacho, and L. Konova, with particular attention to the development of personnel digital competencies and organizational flexibility [3].

Among Ukrainian scientists, the problems of the intellectualization of management processes are studied by I. Prinz and N. Kutsmus, who examine the intellectualization of management processes arising from the integration of digital technologies, analytical tools, and human capital in the context of the digital transformation of the economy [4]. O. Karlova and Y. Malyshevsky focus on intellectualization as a mechanism for adapting enterprises to global digital changes [5], while N. Martynovych and S. Plutalov investigate the impact of digital technologies on the development of creative industries and the transformation of management models [6]. S. Oginok, Y. Rudyuk, I. Andrukhiv consider

intellectualization as the basis for the formation of the knowledge economy and innovative management systems [7].

Despite a significant number of scientific papers, the issues of algorithmization of emergency management decisions in the IT sector remain insufficiently studied. Most of the works focus on the digitalization of business processes or management automation in general, while the specifics of decision-making in conditions of high uncertainty, time shortage, cyber risks and information overload are disclosed in fragments. The issues of the interplay between algorithmic and human factors in crisis management, the limits of AI systems' autonomy, and the risks of erroneous threat prioritization in the emergency response process also remain insufficiently studied.

The article examines the theoretical and applied aspects of algorithmizing emergency management decisions in the IT sector under uncertainty, and substantiates the role of digital analytical systems, artificial intelligence, and data-driven approaches in increasing speed, adaptability, and efficiency of crisis management.

Presentation of the main material. In classical crisis management systems, the key role was played by managerial experience, expert assessment, and the manager's individual competence. Instead, in the modern IT sector, an increasing share of crisis response is shifted to the realm of algorithmic data analysis, automated threat prioritization, and digital scenario forecasting. Which solution is formed based on real-time streaming analysis of information?

Algorithmization of emergency management decisions involves using digital models that automatically process large amounts of data, identify critical deviations, assess risk levels, and generate response options without requiring full human involvement at each stage of analysis. In the practice of IT companies, this is manifested through the integration of artificial intelligence analytics, predictive monitoring systems, digital dashboards, automated incident response systems, and continuous infrastructure monitoring mechanisms. Modern digital technologies are increasingly reorienting management decision-making processes, providing quick access to analytics and increasing management adaptability [4]. This transformation

has become especially noticeable with the widespread adoption of cloud services and distributed digital architecture. Algorithmic systems begin to perform not auxiliary, but a partially coordinating function. They automatically determine the incident's criticality, route tasks, activate response scenarios, and prioritize management actions based on the threat's scale.

It should be noted that the algorithmization of emergency management does not mean the complete displacement of the human factor; rather, with the increasing complexity of digital systems, the importance of managers' ability to work under conditions of incomplete information, non-standard situations, and high-risk dynamics increases. The problem is that the algorithm functions effectively only within the given data logic and predefined behavior patterns. In situations that go beyond the predicted scenarios, over-reliance on automated mechanisms can lead to false threat prioritization or delayed critical decisions.

The above-mentioned contradiction is especially exacerbated in conditions of information overload. In crisis situations, IT systems generate a significant volume of alerts, error messages, automatic alerts, and analytical indicators. As a result, the effect of "digital noise" emerges, in which the increase in information does not always improve the quality of managerial response. Part of modern research in management using artificial intelligence focuses on the fact that excessive automation can create the illusion of full control over the system, even as it reduces managers' ability to critically assess the situation and make non-standard decisions [2].

The value of the organization's cognitive potential increases, which determines the ability of the management system not only to accumulate and process information, but also to quickly identify critical signals, adapt to non-standard situations, and make effective decisions under high uncertainty. In the modern IT sector, cognitive potential is less dependent on the individual competence of the manager and is increasingly shaped by interactions among human capital, digital analytics, algorithmic systems, and collective response mechanisms. As one of the factors influencing the effectiveness

of emergency management, the organization's ability to avoid cognitive overload, information fragmentation, and misinterpretation of risks is increasingly important.

An additional factor in the transformation of emergency management was the emergence of flexible models of work organization - Agile, Scrum, DevOps and SRE approaches. Their peculiarity is to transfer some managerial functions directly to the level of teams and to automated response processes. In such a system, an emergency solution is less formed as a centralized management act, a distributed response model emerges, where algorithms, digital platforms and commands function as a single adaptive system.

The formation of an algorithmic emergency solution usually covers several interrelated stages:

- The first stage is related to the continuous monitoring of the digital infrastructure and the collection of information about the state of the system. At this level, the analysis of network activity, event logs, server infrastructure load, user behavioral deviations, and other digital signals that may indicate a potential threat or critical failure is conducted.
- Stage II involves automatic detection of anomalies and assessment of the criticality of the incident. Algorithmic systems not only record deviations from normal functioning but also determine the scale of risk, the speed at which the threat spreads, and the potential impact on associated digital services. It is at this level that the primary prioritization of managerial actions is formed;
- Stage III covers forecasting possible scenarios and choosing a response model. In modern IT systems, algorithms can analyze past crisis situations, compare the current incident with existing patterns, and generate several management response options based on the scale of the risk.
- Stage IV is associated with the implementation of the management decision and the subsequent adjustment of the response system. As part of this process, some of the actions can be performed automatically - through the launch of security protocols, the isolation of individual segments of the infrastructure, or the

redistribution of digital load. At the same time, strategic control and assessment of the consequences of emergency response are retained by management teams.

Each stage in the development of an emergency solution is associated with specific risks that can affect the effectiveness of crisis management, the accuracy of the response, and the resilience of digital infrastructure (Table 1).

Table 1

Stages of algorithmization of emergency management decisions in the IT sector and key risks of their implementation

Stage	Process content	Main risks
Monitoring and data collection	Continuous monitoring of the state of digital infrastructure, network activity, event logs, behavioral deviations, and technical parameters of the system	Information overload, accumulation of "digital noise", incompleteness or distortion of data, false signals
Anomaly detection and incident criticality assessment	Automatic detection of deviations from the normal functioning of the system and assessment of the scale of a potential threat	Erroneous prioritization of threats, incorrect assessment of the criticality of the incident, and dependence on the quality of algorithms
Forecasting scenarios	Analysis of the possible consequences of the incident and the formation of options for managerial response	Limitations of scenario models, inability of the algorithm to consider non-standard situations, risk of false forecasting
Formation of a management decision	Selection of the optimal response option based on analytical data and algorithmic recommendations	Excessive automation, reducing the role of critical thinking of managers, and cognitive dependence on algorithms
Implementation and adjustment of response	Launch of security protocols, isolation of problematic system segments, redistribution of digital load, and subsequent adjustment of actions	Cascading propagation of errors, delayed adjustment of decisions, and conflict between automated and managerial actions

Source: generated by the author

The above risks indicate that the algorithmization of emergency management decisions is not limited exclusively to the automation of response processes. In fact, a new model of crisis management is emerging, in which the effectiveness of the management system depends on the ability to combine the speed of algorithmic

analysis with the adaptability of human thinking. As a result, not only does the technical reliability of digital systems become of key importance, but so do the organization's cognitive potential, the quality of managerial coordination, and the ability to adjust algorithmic decisions in a timely manner in non-standard crisis situations.

In the practice of the modern IT sector, algorithmization is most actively used in the processes of responding to cyber incidents, digital infrastructure failures, overloading of server systems, loss of service availability and disruption of the continuity of digital operations. With such anomalies, the speed of managerial decision-making directly affects the scale of financial losses, the stability of business processes, and the level of reputational risks.

Modern monitoring systems can automatically detect anomalous activity, analyze user behavioral patterns, block suspicious requests, and isolate individual segments of the digital infrastructure before any human intervention. As a result, some emergency management decisions shift to a semi-autonomous response mode, in which the manager's role shifts from direct decision-making to controlling, adjusting, and assessing the consequences of algorithmic actions.

Algorithmization takes on special significance in the processes of managing cloud infrastructure and digital platforms under high load. In the event of a sharp increase in request volume or technical failures, algorithmic systems can automatically redistribute digital resources, activate backup servers, reroute data, and limit the load on critical segments of the infrastructure. A managerial decision is formed not as a one-time action, but as a continuous adaptive response process.

The logic of managing IT teams in crisis situations is also significantly transformed. In the context of Agile, DevOps, and SRE approaches, some emergency decisions are made directly by rapid response teams, while algorithmic systems ensure the synchronization of information flows, the automatic determination of incident criticality, and the coordination of priorities. A model of distributed crisis management

is being developed, in which the speed of interaction between people and digital systems becomes more important than rigid centralized management.

The spread of remote employment has significantly changed the nature of emergency management in the IT sector. If, under centralized organizational conditions, crisis response was largely based on direct coordination of teams and operational management control, then in the distributed work environment, some traditional management mechanisms lost their effectiveness. The spatial dispersion of teams, the asynchrony of communications, the difference in time zones and the dependence of interaction on digital channels of information exchange make it difficult to quickly agree on decisions in the face of critical incidents.

Under such conditions, algorithmization begins to perform not only an analytical, but also a compensatory function. Algorithmic systems partially replace operational coordination mechanisms, providing automatic incident routing, identifying responsible teams, synchronizing priorities, and maintaining continuity of response regardless of the physical presence of managers or technical specialists. As a result, emergency management decisions are increasingly made under conditions of fragmented managerial interaction, where the speed of algorithmic coordination of actions begins to prevail over that of traditional organizational communication.

The likelihood of losing the context of the managerial decision, duplicating reactions, and creating a gap between the analytical signal and the teams' actual response increases. Under conditions of information overload, this can lead to situations in which the management system formally demonstrates a high speed of digital response, but the actual coordination of actions between the participants in the crisis process remains insufficient. That is why, in the context of remote employment, the algorithmization of emergency solutions increasingly depends not only on the technical accuracy of algorithms but also on the organization's ability to maintain the cognitive integrity of managerial interaction among distributed teams.

Increased algorithmization creates new risks for the management system. Excessive dependence on automated mechanisms is gradually shifting the emphasis

from critical analysis of the situation to trust in algorithmic recommendations. With the constant use of digital decision support systems, there is a risk of cognitive degradation of management processes, which reduces the ability to quickly assess non-standard situations, work outside predetermined scenarios and adapt to unpredictable crisis events. This becomes especially dangerous in conditions of high uncertainty, when an algorithm based on historical data loses its ability to adequately interpret new types of threats or atypical scenarios for the development of a digital crisis.

Under such conditions, the effectiveness of emergency management depends on the organization's ability to maintain its cognitive potential. The development of management models that combine algorithmic response speed with strategic control, adaptive thinking, and management teams' ability to adjust digital decisions in non-standard crisis situations is of key importance.

Depending on the degree of automation of analytical processes, the autonomy of digital response mechanisms, and the role of a person in crisis management, both the structure of decision-making and the nature of managerial responsibility change (Table 2).

Table 2

Levels of Algorithmization of Emergency Management Decisions and Transformation of the Role of the Manager in the IT Sector

Level of algorithmization	Characteristics of the process	The role of the manager	Main risks
Assisted Algorithmization	Algorithms are used primarily for collecting, processing, and visualizing information	The manager independently analyzes the situation and makes the final decision	Information overload, slow response due to excess data
Partial algorithmization	The system automatically identifies anomalies, assesses risks, and suggests response options	The manager controls, adjusts, and selects the response scenario	Excessive trust in algorithmic recommendations, false prioritization of threats
Semi-autonomous algorithmization	Some emergency solutions are implemented automatically based on digital response protocols	The manager mainly performs the function of strategic control and assessment of consequences	Decreased level of critical thinking, cognitive dependence on algorithms

Adaptive Algorithmization	Algorithmic systems are able to independently change response models depending on the dynamics of threats and the behavior of the system	A manager coordinates interactions between digital systems, teams, and crisis scenarios	Loss of transparency of algorithmic decisions, difficulty in predicting system behavior, risk of cascading errors

Source: generated by the author

The classification shown in Table 2 indicates that the development of algorithmization is accompanied not only by an increase in response speed but also by a significant transformation of the manager's role in the crisis management system. If, at the initial levels, algorithms primarily serve an auxiliary analytical function, then under adaptive algorithmization, digital systems gradually become active participants in the formation of management decisions. As a result, there is a growing need to combine algorithmic efficiency with the managerial ability to critically assess non-standard situations, control the logic of digital responses, and adjust the actions of automated systems in a timely manner in the face of unpredictable crisis scenarios.

Conclusions. The algorithmization of emergency management decisions in the modern IT sector is no longer solely an automation tool and is gradually becoming an independent model of crisis management, in which digital systems participate not only in information processing but also in shaping the logic of responding to crisis events. In conditions of high uncertainty, the effectiveness of emergency management is determined by the ability to integrate the algorithmic speed of analysis with the cognitive adaptability of managerial commands.

The strengthening of algorithmization is accompanied by the transformation of the role of the manager, from a subject of direct decision-making to a coordinator of interaction between digital platforms, analytical systems, and rapid response mechanisms. As a result, an effective cognitive capacity management system in the face of information overload and non-standard crisis situations becomes a key resource for the resilience of IT organizations.

Excessive dependence on automated algorithms poses risks of cognitive degradation in management processes, loss of critical thinking, and reduced ability to

respond adequately to unpredictable digital threats [8; 9]. That is why a promising model for the development of emergency management in the IT sector is not the complete autonomy of algorithmic decisions, but the formation of adaptive crisis response systems, within which algorithmic analytics, human expertise, and collective management mechanisms function as a single integrated system.

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