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# ANN as innovative technology for economical efficiency of educational management during crisis times

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***Abstract.*** *Education today faces uncertainty and complex crises driven by economic, political, and technological challenges. Traditional management models lack the flexibility needed to ensure sustainability, making innovative solutions essential. Artificial Neural Networks (ANNs) provide powerful tools for predictive analytics, risk management, and adaptive planning in educational systems. They enable data-driven decisions, personalized learning paths, and scenario modeling under crisis conditions. Both shallow and deep ANNs improve resilience and continuity, while hybrid models combining neural and symbolic approaches enhance interpretability and adaptability. These technologies shift management from reactive strategies to proactive, predictive approaches, ensuring educational quality and stability during crises.*
***Keywords:*** *innovative economy, educational management, artificial neural networks, crisis.*

## Introduction.

Innovative management is an integral factor in increasing economic efficiency in modern conditions [1]. Its implementation allows enterprises not only to optimize costs and increase productivity, but also to form a sustainable development strategy in conditions of high market turbulence [2]. Innovations provide the ability to quickly respond to changes in the external environment, create unique products and technologies, and increase customer satisfaction [3], [4]. Modern business conditions are characterized by a high degree of uncertainty [5], global economic shocks [6], political crises, technological changes [7] and accelerated digitalization [8]. These factors create an unstable business environment in which traditional approaches to management become insufficient [9]. Companies are forced to look for new mechanisms for adaptation, sustainability and competitiveness [10]. In this regard, it is innovative technologies in management that acquire strategic importance [11]. Innovative management technologies include the use of digital platforms [12], artificial intelligence systems [13], Big Data and analytics, cloud solutions, business process automation, blockchain, cyber-physical systems, as well as predictive analytics and machine learning methods [14]. Their implementation allows managers to quickly respond to changes, model development scenarios, predict risks and manage resources in crisis conditions.

## The Main Part.

The modern education system faces serious challenges: economic crises, socio-political instability, pandemics, military conflicts and rapid technological development.

These factors lead to a high degree of uncertainty and the need for adaptive management. Traditional planning and control methods are not flexible enough, so there is a need for innovative approaches that can process large amounts of data, predict risks and make optimal decisions in real time. One of such tools is artificial neural networks (ANN).

ANN imitate the work of the human brain and are able to identify hidden dependencies in data, analyze complex processes and predict the consequences of management decisions [15]. In the context of educational management, neural networks are used for:

1). Forecasting the need for educational resources, personnel risks, student recruitment dynamics in unstable conditions;

2). Adaptive planning of educational programs taking into account changes in the labor market and societal demands;

3). Personalization of the educational process (formation of individual learning trajectories, determination of the level of preparation, identification of risk zones in students);

4). Evaluation of the effectiveness of educational reforms and strategies based on big data analysis;

5). Decision support systems (DSS) for managers and administrators in crisis situations (e.g. budget allocation during funding cuts, organization of distance learning during force majeure).

In crisis conditions, ANNs allow not only to promptly respond to changes, but also to predict critical points - for example, the likelihood of a mass outflow of students, overload of teachers or a decline in the quality of education. This ensures proactive anti-crisis management, minimizing losses and increasing the sustainability of the educational system.

**Conclusions.**

1. Artificial neural networks are becoming a strategic tool in education management in the era of uncertainty and crisis. Their advantages: flexibility and adaptability in an unstable environment; high accuracy of forecasts due to the analysis of big data and hidden correlations; support for data-driven decisions, not intuition; personalization and an individual approach to training and personnel management; risk reduction and increased sustainability of the educational system. The introduction of neural networks in educational management allows us to move from reactive management to a predictive and strategic approach, ensuring the continuity and quality of education even in the most difficult conditions.

2. The use of shallow and deep ANNs in education management increases the system's resilience to crises, allowing: to provide predictive analysis of risks and crisis situations; to implement adaptive resource management algorithms; to maintain the flexibility of educational strategies based on data.

Thus, neural networks are becoming a key tool for anti-crisis management of education, facilitating the transition from reactive approaches to proactive management based on intelligent analytics.

**Discussion.**

As stated above, modern education faces many challenges: economic shocks, socio-political instability, pandemics, technological shifts and military conflicts. These factors form complex crises that are characterized by multidimensionality, high dynamism and interconnectedness of risks. In such conditions, traditional methods of education management prove insufficient. It is necessary to introduce innovative intelligent technologies that can adapt to a changing environment and ensure the sustainability of educational processes.

One of the most promising technologies is hybrid artificial neural networks, which combine the advantages of subsymbolic approaches (deep neural networks, machine learning) and symbolic methods (logic, expert systems, ontologies) [16]. Such integration allows not only to process large volumes of data, but also to interpret the results, ensuring the transparency of decisions and their compliance with regulatory requirements.

Hybrid artificial neural networks are a new level of intelligent technologies that provide not only data processing, but also knowledge integration for sustainable education management. Their key advantages are: adaptability to complex crises and multidimensional uncertainty; a combination of interpretability and computing power; support for predictive and proactive management rather than reactive measures; the ability to integrate with forecasting, monitoring and quality control systems. The introduction of hybrid ANNs allows for a transition from fragmented solutions to a comprehensive intelligent strategy for education management, ensuring its sustainability even in the face of strong external shocks.

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