Digital Transformation In Vocational Education: Theoretical Basis For Increasing The Efficiency Of Management Decision-Making

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ABSTRACT

This article theoretically analyzed the impact of digital transformation processes on the management system of vocational education and training (VET) institutions. The limitations and inefficiency of traditional management paradigms in the context of the digital economy were studied. Classical theories of educational management and decision-making (formal, rational, collegial, political, etc.) were critically analyzed, and their inability to meet modern challenges was substantiated. Based on this analysis, new theoretical approaches were proposed, which integrate the principles of data-driven decision-making and agility. Key principles such as contextual agility, data-informed iteration, stakeholder integration, and strategic foresight were identified, and their theoretical essence was revealed.

Keywords: Digital transformation, vocational education, management decision, effectiveness, data-driven decision-making, adaptive management, education management, decision-making approaches.

Introduction. The rapid development of digital technologies on a global scale is requiring fundamental changes in all spheres of socio-economic relations, including the education system. In the conditions of the Fourth Industrial Revolution, the requirements of the labor market are changing dramatically, traditional professions are being transformed, and new specialties requiring digital competencies are emerging. This process, in turn, sets before the vocational education system the task of not only updating the content of curricula, but also a fundamental revision of the entire educational process, in particular, its management system. The digital transformation of vocational education institutions (VET) has now become not just a means of technological innovation, but a strategic necessity that ensures their competitiveness, adaptability and long-term development. In these difficult conditions, the quality, justification and timeliness of management decisions are emerging as a decisive factor determining the success of the institution. Traditional decision-making methods, often based on experience, intuition or established procedures, are losing their effectiveness in a digital environment characterized by rapidly changing, uncertain and large amounts of information. Therefore, the development of scientific and theoretical foundations for increasing the effectiveness of management decisions of managers of educational institutions in the conditions of digital transformation is one of the most pressing problems in modern educational management.

An analysis of the scientific literature on the topic shows that there are several fundamental theoretical approaches describing decision-making processes in the field of educational management. According to the classification proposed by T. Bush (2003), management

theories can be divided into such groups as formal, collegial, political, cultural, subjective and ambiguity. Formal approaches view the organization as a system with clear goals and a hierarchical structure, and consider decisions as the result of rational choices. Collegial and political approaches emphasize the importance of participation, negotiation, and consensus-building among diverse stakeholders in decision-making. Classical theories of decision-making, including Simon's bounded rationality and Cohen, March, and Olsen's "Quitis" theory, also help to understand the complex and uncertain conditions in educational institutions. However, most of these theories are based on the analysis of industrial-era organizations and do not fully capture the opportunities and challenges presented by digital technologies, in particular, Big Data analysis.

The above analyses indicate a serious theoretical contradiction and scientific gap in the management of vocational education. On the one hand, the process of digital transformation is creating a huge flow of data for management and expanding the technological capabilities for making data-driven decisions. On the other hand, traditional, often data-poor management practices still dominate in the practice of vocational education leaders. In existing academic work, digital transformation and decision-making theories in education have often been studied separately. A comprehensive theoretical basis for improving the effectiveness of decision-making for managers of ICT, taking into account the specific features of digital transformation, which inextricably links these two areas, has not been sufficiently developed. Based on this, the purpose of this article is to scientifically substantiate the general theoretical principles and approaches aimed at increasing the effectiveness of management decision-making by the heads of vocational educational institutions in the context of digital transformation strategies.

Methods. This article is based on a theoretical and conceptual analysis, in which the fundamental concepts and approaches in the field of vocational education management and digital transformation were systematically studied and comparatively analyzed. The main concepts that formed the theoretical basis of the study are as follows: The concept of digital transformation (DT) was initially considered simply as the introduction of information technologies, but today its content has expanded significantly. It is defined not only as the introduction of technologies, but as "progressive change leading to the restructuring of education". Based on these approaches, the author's definition is proposed as follows: Digital transformation in vocational education is a strategic and systemic process aimed at radically changing educational processes, management systems and relationships with stakeholders through the deep integration of digital technologies and data analysis tools, and at responding flexibly and effectively to the demands of the labor market. This process includes not only technological, but also organizational and cultural changes. Management decision-making is a central element of management activity and is described as "a conscious and purposeful action aimed at choosing the most appropriate option from among alternatives." From the perspective of educational management, as T. Bush (2003) emphasizes, any management decision must be inextricably linked to the educational goals, values, and mission of the institution. In the digital environment, the traditional decision-making process is increasingly relying on data analysis, which has the potential to increase the level of objectivity and validity. Data-Driven Decision Making (DDDM) is "the process of making objective and justified decisions based on the analysis of data collected from various aspects of the organization's activities." This approach is contrasted with traditional methods that are "based on intuition and experience." In the field of vocational education, DDDM has been proposed as an important tool for adapting curricula to labor market requirements, effectively allocating resources, improving student learning outcomes, and increasing graduate employability. Existing theories of management decision-making have been critically analyzed from the perspective of digital transformation. Formal and Rational approaches assume a clear hierarchy, defined goals, and complete information for the decision

maker. They can be effective in stable environments, but their applicability is limited in the context of the uncertainty, rapid change, and information overload of the digital era. Collegial and Political approaches take into account the participation of stakeholders and the negotiation of interests between different groups. This is important in reducing resistance to change in the process of digital transformation. However, they can slow down the decision-making process and leave data-based objectivity in the shadow of group interests. The theory of "Ambiguity" well describes the conditions of organizational anarchy, unclear goals and changing participants. However, this theory is mainly descriptive in nature and does not offer a clear strategy for leaders. Based on this analysis, it was argued that none of the traditional approaches fully meet the requirements of the digital era. The need for a new, integrative approach that combines rationality, cooperation and adaptability to the situation was proposed (Table 1).

Table 1. Comparative analysis of theoretical approaches to management decision-making

The name of the	The main idea	Advantages	Disadvantages	Restrictions in RT conditions
Formal/Rational	An organization is a hierarchical system. Decisions are made by choosing the optimal option to achieve a goal.	Systematicity, accuracy, ease of control.	Rigidity, bureaucracy, slow reaction to external changes.	It cannot adapt to a rapidly changing environment and hinders innovation.
Fixed rationallity	The decision maker does not have complete information, so he chooses not the optimal, but rather a "satisfactory" solution.	Proximity to real life speeds up decision-making.	The likelihood of making suboptimal decisions, a tendency towards personal bias.	It ignores the possibilities of Big Data analysis.
Collegial	Decisions are made collectively, based on general discussion and consensus.	High-level participation facilitates decision-making.	The slowness of the process, the spread of responsibility.	Ineffective in situations where quick decisions are required.
Political	Tashkilot is an arena where different interests are brought together. The results are the result of the musicians and the balance of forces.	Takes into account the diversity of interests.	Group interests may prevail over data-based objectivity.	Short-term political gains may take precedence over strategic goals.

The analysis presented in this table shows that traditional approaches cannot fully reflect the complex and dynamic nature of digital transformation. The digital era requires leaders to have both data-driven analytical thinking, rapid adaptation to changing conditions, and effective cooperation with stakeholders. Therefore, there is a need to develop a conceptual framework that synthesizes existing theories and adapts to new realities.

Results. Based on the theoretical and comparative analysis conducted and the identified scientific gap, a new approach was developed to improve the effectiveness of managerial decision-making by heads of vocational educational institutions. This approach, abandoning the rigid hierarchy and

one-time decision-making paradigm of traditional theories, combines the data analysis capabilities provided by digital technologies with the principles of collegiality and adaptability. Its main idea is to view decision-making not as a final result, but as an iterative and dynamic process that is constantly improving based on a constant flow of information.

As a result of theoretical analysis, four interrelated and complementary principles were identified that increase the effectiveness of management decisions. These principles are designed to respond to the main challenges facing the head of the CMO in the context of digital transformation:

1. Contextual Agility: This principle assumes that decisions are made not on the basis of rigid, immutable rules, but on the basis of constant monitoring and analysis of internal and external factors. The leader does not wait for changes, but monitors them and makes quick adjustments to his strategy.

2. Data-Informed Iteration: According to this principle, decisions made are not considered final. They are put forward as hypotheses that need to be tested. Once the decision is implemented, its results are precisely measured and analyzed through digital systems. The data obtained serves as the basis for further improving the next decision.

3. Stakeholder Integration: This principle implies the active involvement of not only the administration and teachers, but also students, employers and other social partners in the decision-making process through digital platforms. This ensures that decisions take into account the needs of all stakeholders and achieve their support.

4. Strategic Foresight and Proactive Management: This principle implies the use of data analysis not only to solve current problems, but also to predict and prepare for future trends. Big data analysis allows you to predict changes in the labor market in advance and determine the long-term strategic priorities of the organization. Thus, the proposed theoretical approaches provide managers of KTOs with the methodological basis necessary to correctly determine the direction in the complex conditions of digital transformation, manage uncertainty and ensure the sustainable development of the organization. They serve to overcome the limitations of traditional management approaches and adapt the decision-making process to modern requirements.

Discussion. The theoretical principles proposed in this article do not deny existing theories, but aim to synthesize them and adapt them to the specific requirements of the digital era. This approach takes the idea of data-driven learning from Rational Theory, but abandons its unrealistic assumptions of "complete information" and "optimal solutions." Instead, it proposes continuous improvement of decisions through an iterative approach. It also fully supports the participatory principle of the Collegiate Approach, but emphasizes the need to accelerate this process with digital tools and enrich it with objective data. This approach is consistent with the results of research on the four dimensions of technological adaptation in vocational education systems: institutional readiness, teacher competence, curriculum integration, and industry-education cooperation. While these studies have emphasized the importance of these factors, the proposed principles provide the necessary governance mechanisms for effectively managing these dimensions. For example, the principle of "stakeholder integration" for the development of "industry-education partnerships" allows for constant feedback from employers and its rapid integration into training programs. One of the most fundamental aspects of the proposed approach is that it changes the traditional view of management decisions. Traditional theories see "decisions" as final products. The new approach interprets "decision-making" as a continuous, learning-based process. Here, each decision is a hypothesis to be tested, and each result is valuable information for determining the next step. This, in turn, brings the MSE closer to the "learning organization". The constantly changing nature of the digital environment means that today's correct decision may be outdated tomorrow. Therefore, it is more important to make quick decisions, monitor the

result and, if necessary, quickly make corrections. The scientific and practical importance of the proposed principles is manifested in several aspects. From a scientific point of view, this article strengthens the theoretical connection between the fields of educational management and digital transformation. In practice, these principles can serve as a methodological basis for training programs for managers of the Ministry of Education and Culture. They are recommended for use as a practical guide in the development of strategic development plans of the institution, allocation of resources and improvement of the quality management system.

However, it is necessary to recognize that this study has certain limitations. First, this article is purely theoretical in nature. The effectiveness of the proposed principles in real conditions requires separate empirical research. Second, their successful implementation depends on the level of digital literacy of managers and employees, the existing management culture in the organization, and the availability of the necessary technological infrastructure. It is worth emphasizing that the implementation of these principles is not just a technical task, but a deep cultural change. These limitations and considerations identify several promising directions for future research:

1. Conducting an applied study to experimentally test the proposed principles on the example of one of the Uzbek vocational educational institutions.
2. Developing a methodology for assessing the digital and analytical competencies of managers of vocational education and training institutions necessary for data-based decision-making.
3. Exploring the possibilities of adapting Business Intelligence (BI) tools and dashboards that practically support the proposed principles to the needs of the vocational education system.

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