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A Conceptual Approach to Solving the Problem of Sustainable University Development in the Period of a New Technological Order / Концептуальный подход к решению проблемы устойчивого развития университета в период нового технологического уклада

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Аннотация: предметом статьи является формирование концепции обеспечения устойчивого развития университета в период нового технологического уклада; объектом статьи выступает университет; целью работы является обеспечение устойчивого развития университетов в процессе формирования нового технологического уклада; для достижения этой цели решаются такие задачи данного исследования: исследования и уточнения понятия устойчивого развития университета; изучение источников риска потери устойчивости в процессе перехода университета к новому технологическому

укладу; анализа структурных составляющих концепции устойчивого развития университетов; актуальность статьи связана с интенсивным формированием нового технологического уклада в экономике и жизни общества, что потребует адаптации университетов к изменениям внешней среды научная новизна данной статьи определяется формированием концепции обеспечения устойчивого развития университета в период нового технологического уклада; выводами статьи является утверждении о необходимости формирования политики устойчивого развития университета в период формирования нового технологического уклада; в работе обоснована необходимость концептуального подхода к обеспечению устойчивости университетов в период их перехода к работе в условиях нового технологического уклада; научными методами в настоящей статье выступают: теория устойчивого развития, исторический и логический анализ, теория высшего образования; теория технологических укладов; теория иерархических систем;, системный анализ; теория прогнозирования; теория бережливого производства, экспертные методы;

Ключевые слова:

концепция, устойчивое развитие, университет, технологический уклад, система высшего образования, фактор, инструмент, управление, эффективность, результ

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Introduction. This article is relevant to the risks universities face when entering a new technological order in society and the economy. The formation of a new technological order is associated with the emergence of new risks in university development, which may decrease competitiveness and the degree of sustainability of university development during this period.

This article hypothesizes that a conceptual approach to solving the problem of university development is necessary to ensure the sustainability of a university's growth in the new technological order.

The work aims to ensure the sustainable development of universities in forming a new technological order.

To achieve this goal, this study looks at:

- research and clarification of the concept of sustainable development of the university;

- study of the sources of the risk of loss of stability in the process of transition of the university to a new technological order;

- analysis of the structural components of the concept of sustainable development of universities.

This article focuses on the university during a new technological order.

The article's subject is the formation of the concept of ensuring the university's sustainable development in the new technological order.

The study of scientific publications on the topic of this article suggests the following:

At the beginning of the 21st century, universities' activity models were transformed, moving to the "3.0 model" [1, pp. 114–118]. At the same time, new models of universities are being developed abroad, for example, at Lincoln University in the UK [2, pp. 181–197]. Researchers note the dynamic nature of the development of regional universities [3, pp. 10–19]. This point of view is expressed in a situation of dynamic development. There is a need to optimize complex strategic measures to develop a university's human capital [4, pp. 31–38].

At the same time, it is noted that changes also occur at a personal level [5, pp. 171–188]. In a situation of dynamic changes, it is important to solve the problem of sustainable development of the higher education system [6, pp. 102–104]. The role of universities in ensuring the sustainability of the higher education system is great [7, pp. 8–12]. The opinion is expressed that it is necessary to provide the university's stability in the modernization of the entire higher education system [8, pp. 39–46]. At the same time, analysts note that the level of stability of the regional higher education system is influenced by the interests of large actors (subjects) of the regional economy [9, pp. 897–906]. At the same time, university staff argue that the training of undergraduates at universities should contribute to their sustainable development [10, pp. 41–45].

The pandemic also impacted the degree of stability of the higher education system [11, pp. 59–62]. Foreign scientists believe that the problem of forming a paradigm of sustainable development for the higher education system is also important for their countries [12, p. 85]. In Kazakhstan, one of the methods of ensuring the sustainable development of the higher education system is the introduction of technologies for crediting training [13, pp. 42–44]. Scientists study the general problems of sustainable development of the higher education system in the regions [14, pp. 176–178].

At the same time, the region's higher education system can act as a factor in the sustainable development of a particular area under the conditions of digitalization [15, pp. 68–70]. Therefore, research is being conducted on the region's higher education system regarding the impact of education on the sustainable development of the entire region [16, pp. 321–337]. Scientists pay attention to the fact that transformations in the higher education system take place against the background of forming a new technological order in society and the economy [17, pp. 37–40].

It is noted that conceptual transformations are needed in universities' work in connection with forming a new technological order [18, p. 5–15]. It is predicted that the further development of the higher education system in a new technological way may take the form of the development of an educational ecosystem, and the importance of mentoring will increase [19, pp. 85–95]. At the same time, forming university student ecosystems is also likely [20].

The results of this analysis of publications on the article's topic suggest that the problem of ensuring the sustainable development of universities during the formation of a new technological order is relevant.

Method: Under the mechanism of ensuring the sustainability of the development of the higher education system during the formation of a new technological order, we will understand a system of methods and tools for maintaining the sustainability of this

development.

Creating a new technological basis for the economy and society creates additional risks for the sustainability of the development of the higher education system. The new technological order will be characterized by intensive development of the following types of technologies: nanotechnologies, neurotechnologies, digitalization technologies, information technologies, biotechnologies, and others [18, p. 5–15].

To consider the structure and components of the mechanism of sustainable development of higher education, it is necessary to clarify the concept of sustainability in developing this system. It is known that from an economic point of view, such a development of an organization is considered sustainable, in which there is no decrease in any of the types of assets of this organization. The disadvantage of this definition is that in the conditions of changing the technological basis during the transition to a new technological order, a change in the ratio of various types of assets may be objectively required. In particular, the role of intangible assets may increase during the transition to a new technological order.

In the theory of large systems, a system's stability is understood as its ability to return to its initial state after a specific external influence has been carried out. This definition of system stability also has a drawback. This disadvantage is determined by the fact that the higher education system must undergo constant innovative changes. Such changes are necessary to ensure that the higher education system meets the requirements and promising trends in society and the economy.

In 2022, the external impact on the higher education system can be recognized as the impact of factors related to the economic crisis and its transition to a new technological order. The global crisis is precisely the form and mechanism for transitioning society and the economy to a new technological order. If the higher education system cannot adapt adequately to new factors, there may be a loss of stability in its development.

When analyzing this situation, it is recommended that as part of the socio-economic development management system, the higher education system should be in a state of conjugation with the economy and public institutions. Violating such conjugacy of the conditions of the higher education system, economy, and society can be considered as one of the signs of the loss of stability of the higher education system. In addition, the violation of such a conjugacy of the conditions of the higher education system of the economy and society can cause a loss of competitiveness and stability of the economy and society.

This makes it possible to interpret the sustainable development of the higher education system as a continuous process of maintaining the conjugacy of the states of this system, economy, and society. This conjugacy of the states of the higher education system is most relevant during the crisis. This is because, during the crisis, there were rapid structural changes in the economy and society. During the crisis, the technological basis of activity, the structure of markets, management methods, business forms, and more are changing rapidly.

The state of the higher education system economically and socially can be characterized by the following signs:

- the structure of the higher education system meets the existing and future needs of the economy and society;

- the quality of educational products of the higher education system meets the needs of society and the economy;

- the organizational culture of the higher education system corresponds to the trends of the new technological order;

- the costs of the education system of various stakeholders correspond to their financial capabilities;

- the higher education system has a mechanism for adapting the higher education system to the observed changes in the economy, society, and more.

The risks of reducing the stability of the processes of economic and social development can manifest themselves in the following:

- in reducing the quality of higher education to a level at which it is impossible to maintain the competitiveness of the economy and society;

- a low proportion of graduates who find a job in their specialty due to the discrepancy between the request of economics and the structure of graduate specialties in the higher education system;

- inaccessibility of higher education for a significant proportion of the population in terms of financial indicators and other.

The conjugacy of the states of the higher education system, economy, and society can most effectively ensure the development of the higher education system within the framework of the ecosystem approach [19, pp. 85–95]. This statement is based on the fact that the ecosystem approach in higher education allows to ensure:

- the comprehensive provision of educational services to consumers;

- to harmonize the interests of all stakeholders in this process;

- to minimize possible damages to elements of the surrounding socio-economic environment and others [19, pp. 85–95].

Thus, the first element of the mechanism for ensuring the sustainable development of the higher education system can be recognized as forming an ecosystem approach to developing the higher education system. The second element of this mechanism can be called the further development of distance education based on information technology (smart education). This segment of higher education can increase the sustainability of the higher education system.

Distance learning can be effective in obtaining a higher education and additional professional education. However, in developing this form of education, it is necessary to take into account the following risk factor associated with it: the risk of the impossibility of transmitting implicit knowledge by verbal methods. All knowledge transmitted through the education system can be divided into explicit and tacit knowledge. Explicit knowledge is conveyed by verbal means. Tacit knowledge can be transmitted only by nonverbal methods in personal communication between the teacher and students.

The sources of implicit knowledge in an educational product can be the processes of aggregation (system unification) of elements into a single whole (product, system), the interdisciplinary nature of research, human relations within professional institutions, and

others. Due to the increasing complexity of the objects of the external world in the economy and society, the importance of implicit knowledge can objectively increase. At the same time, tacit knowledge can be a source of synergy in social production. When developing SMART education, the process of transferring tacit knowledge should be considered to be concentrated on personal communication between the teacher and the student.

The third element of the mechanism for ensuring the sustainable development of the higher education system is the wider use of the project form of higher education. The analysis shows that innovations will become continuous and permanent during the development of a new technological order. The main form of implementation of innovative activities is innovative projects. Such an expansion of innovative activity can lead organizations to transition from a process model of activity to a project model of their activities.

When switching to the project model of organizations, the following changes in their activities can be observed: changes in the organizational structure (transition to a matrix structure); in working with personnel, a transition from the management of functional units to the formation and management of project teams is possible; changes in organizational culture are viable due to the increasing role of the organization's innovative values (encouraging innovation activity), and more.

All this may lead to the need for an accelerated transition of the higher education system to a more active use of the project form of such education. It is necessary to consider that the project form of higher education has several distinctive features. Such unique features of higher project education include the following: learning through the implementation of educational projects occupies a significant place in the structure of the student's workload; there is a comprehensive use of the knowledge acquired by the student in the project; students are trained to work as part of project teams; there is a more active development of students' activity skills; teams practice participatory project management; there is a development of horizontal communication between students; there is a formation of a horizontal style of communication between the teacher and students and others [19, pp. 85–95].

Presumably, in 2022, the main constraining factors (risks) for the intensive implementation of the project form of higher education may be a small number of university teachers with practical skills in implementing projects in the economy and society, a small proportion of teachers with a full range of competencies for quality project management (analysis shows that effective project management requires knowledge at least in more than eight fields of expertise: law, finance, investment, technical sciences, marketing, management, personnel management; entrepreneurship); low interest of real business in the implementation of joint projects with the participation of students; the level of socialization of knowledge about the project model of organizations and the project form of higher education, and more.

The development of the project form of higher education can become an essential element of adapting higher education to the changes taking place. This is because implementing joint projects with organizations of the real economy and society can be an effective tool for adjusting a university to the requirements and conditions of the external environment of the higher education system. At the same time, each joint project can be considered a separate experience of adapting the university to the demands of the external environment. Therefore, through joint projects, the conjugation of the conditions of the real economy and the educational process at the university will be ensured. Such joint implementation of projects will increase the sustainability of both the higher education system and the real

economy. This idea must be conveyed to the leaders of the real economy in the process of socialization of knowledge about the project form of higher education.

The fourth element of the mechanism for ensuring the sustainability of the development processes of the higher education system can be the application of lean production methodology in higher education. The inclusion of lean production methods in ensuring the sustainability of the development of the higher education system can be linked to the analysis of the causes of the 2008 crisis. As a result of such an analysis, it was found that one of the leading causes of this crisis could be a violation of the principles of thrift in large corporations. On this logical basis, the introduction of lean manufacturing principles in the higher education system can reduce all types of unproductive losses. At the same time, such a reduction in losses in the higher education system can lower the risk of a crisis in this system. Consequently, the introduction of lean manufacturing principles in the higher education system can increase the sustainability of its development.

The fifth tool for ensuring the sustainable development of the higher education system can be the creation of student ecosystems at universities. Research shows that the creation of such student ecosystems can contribute to increasing the sustainability of the development of the higher education system for the following reasons: establishing closer contacts and communications between society and universities, increasing the level of comfort of students' everyday lives, reducing the unproductive wastage of time and effort by students in extracurricular work; raising the level of student involvement in the educational process; increasing the level of student motivation [20]. All these factors work to improve the degree of sustainability of the development of the higher education system. For this reason, creating student ecosystems in universities can be considered a tool to ensure the sustainability of the development of the higher education system.

The sixth direction of increasing the sustainability of the higher education system's development process during the formation of a new technological order is the further development of innovative organizational culture in universities. The analysis shows that during the formation of a new technological order, the following types of technologies can develop most intensively: nanotechnology, neurotechnology, digitalization technologies, information technology, and biotechnology (Glushchenko V.V., 2020). Developing these technologies requires new relations between people within the framework of professional and public institutions.

Therefore, universities can increase the sustainability of their development by developing such programs: programs for the modernization of university activities and programs for transforming the university's organizational culture. Particular attention should be paid to implementing innovative values of organizational culture when developing programs to modernize the organizational culture of universities.

Revision of all educational programs may be the basis for forming programs to modernize university activities. Such an audit of academic programs should be carried out to integrate new types of technologies into these programs. At the same time, it should be considered that, as student surveys show, the student no longer considers the teacher the primary source of knowledge. This function is performed by the Internet.

In the 21st century, a teacher should help students develop research skills, work in small groups, develop business and interpersonal communication skills, present their results, and more. This requires changes in the university's organizational culture.

Organizational culture performs two functions. The first function is to ensure the university's adaptation to the changes taking place. This is a function of external adaptation. The second function of the university's organizational culture is the internal coordination of all elements of the educational process in the interest of the external adaptation of this university. Therefore, the university's organizational culture can be considered an important part of the mechanism for ensuring the university's sustainable development. In assessing the role of organizational culture, it should also be taken into account that in the 21st century, competition between innovatively active universities will be conducted precisely at the level of organizational cultures (and not educational products).

The seventh element of the mechanism for ensuring the sustainable development of universities can be a product approach to their activities. The analysis shows that to improve the quality of education, it is important to form a product approach. This approach increases the efficiency of spending university resources. Therefore, to ensure the sustainability of education development, it is important to develop a product approach in the activities of universities. Scientists predict that the product approach may replace the competence approach at universities. Let's explain the differences between competence-based and product-based approaches in the activities of universities. With a competency-based approach to the educational process, in addition to knowledge, the student is also given practical skills.

The product approach at a university emphasizes the formation of educational products. An academic product can be called a systematic combination of knowledge, skills, research skills, and organizational and professional culture. Project-based higher education is one technology for creating educational products. At the same time, the product approach can also be implemented within the framework of traditional subject education at universities.

Discussion. The formation of a new technological order in the economy and society dramatically increases the urgency of ensuring the sustainability of the higher education system's development process. During the crisis, the issue of ensuring the sustainability of the higher education system's development should be given increased attention.

To ensure the sustainability of the development of universities in a period of intense change, it is necessary to create a mechanism to maintain the sustainability of such development of universities. This is because creating such a mechanism will ensure the comprehensive nature of stakeholders' impact on the sustainability of universities. At the same time, it will also be possible to coordinate the degree of influence of all stakeholders on maintaining the sustainability of university development. This is important not only for universities but also for the entire economy. It should be remembered that the sustainable development of universities in the period of a new technological order is considered an important factor in ensuring the sustainability of the regional economy itself.

This analysis shows that the sustainability of development is influenced by such characteristics of the university's activities as the level of customer orientation and the degree of customization of scientific and pedagogical activities of the university.

Low customer orientation in a university can lead to a loss of stability in its development. Such a loss of sustainability in development may result from a decrease in the quality of higher education. In turn, such a decrease in the quality of education may result from a misunderstanding of trends in the development of economic sectors and specific enterprises. Errors in assessing trends in the development of the industry (or region) may result from the university's insufficient customer orientation. Therefore, increasing the

university's degree of customer orientation can be a way to improve the sustainability of its development process in the context of its transition to a new technological order.

Using a project form in higher education can increase universities' customer orientation. At the same time, the university's customer orientation means that it is aware of not only the partner organization's current activities but also its customer orientation, which also means that this university knows the forecasts for the development of partner organizations.

The customization of the university's activities should be studied as the degree of concentration of the university's efforts on specific areas of its activities. Customization in the university's activities makes it possible to increase resource use efficiency. Therefore, such customization of the university's activities should be considered to improve the sustainability of the university's development process. This is because the customization of the university's activities reduces the risk of loss of sustainability of the university's development due to excessive diversification of scientific and educational activities. The risk of excessive diversification of the university's activities may be associated with the conglomerate nature of the organizational structure of a significant part of universities. The transition to a new technological order opens up many alternative development directions (nanotechnology, information technology, neurotechnology, etc.). This increases the risk of unproductive losses due to the dispersion of university resources. Customization of the university's activities reduces the risk of unproductive losses associated with excessive "dispersion" of its resources in many areas of its activities.

To reduce the risks to the university's sustainable development, it is necessary to choose the right direction for its development. In turn, to choose the right direction for the university's development, it is necessary to assess the opportunities and threats of the external environment and the competitive advantages and disadvantages of the university. The SWOT analysis methodology, the Boston Consulting Group matrix, and other strategic marketing planning tools can be used to justify the university's development directions.

Based on the results of the SWOT analysis of the university's activities, it is possible to form a list of measures aimed at minimizing threats to the external environment, measures aimed at using the opportunities of the external environment by the university, measures aimed at reducing the weaknesses (competitive disadvantages) of the university; measures aimed at effectively using the strengths (competitive advantages) of the university. All possible directions of the university's activities should be studied using the concept of alternative costs within the university's financial management strategy framework.

In general, the control and management of the sustainability level of the university development process during its transition to a new technological order can be recognized as one of the most urgent tasks of university management in this period. To coordinate measures aimed at ensuring the sustainability of university development, a policy of ensuring the sustainability of university development in the context of transition to a new technological order can be developed and implemented. The policy of ensuring the sustainability of universities can be understood as a set of coordinated measures aimed at preventing the loss of stability by the university in the process of its development during the transition to a new technological order.

Conclusion. This paper describes the concept and defines the structure of ensuring the sustainability of the development of universities and the higher education system in the transition to a new technological order. It emphasizes that during the formation of a new technological order, the problem of ensuring the sustainability of the development of

universities is becoming more acute. Analyzing the factors that affect the sustainability of universities' work allows us to conclude that customization and customer orientation in the functioning of universities can ensure such sustainability. At the same time, the tools for ensuring the sustainability of university development can be the ecosystem method of university development, the further development of SMART education, more active use of the project form of higher education at universities, the practical application of lean production methodology; the product approach in university activities; the development of innovative organizational culture and more. The materials of this article allow us to recognize the sustainability of university development as one of the most important tasks of university development management.

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